Economics of transmission capacity services

A REPORT PREPARED FOR THE AUSTRALIA COMPETITION AND CONSUMER COMMISSION

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Executive summary

Frontier Economics (Frontier) has prepared this report for the Australian Competition and Consumer Commission (ACCC) on the economics of transmission capacity services pricing.

TRANSMISSION CAPACITY SERVICES

Transmission services are high capacity wholesale data services. These services are the 'building blocks' for voice, data or other communications between transmission points located throughout Australia. Carriers and carriage service providers can use the transmission capacity service to set up their own networks for aggregated voice or data channels or for integrated data traffic (such as voice, video and data).

Transmission services are sold to customers on the basis of 'point to point' capacity. However, because they are critical to network operation they are also usually sold with redundant paths to prevent network failure if one route fails. These may be purchased from a separate supplier in some cases.

Transmission services are competitively supplied on some routes – mainly inter-capital and some regional routes. The ACCC has removed access regulation on these routes.

ISSUES ADDRESSED IN THIS REPORT

The ACCC sought advice from Frontier on:

- the price structures for transmission capacity services that would best promote efficiency and competition;
- the merits of various cost-based pricing approaches to determining regulated prices for transmission capacity, and, in particular, whether a single cost base or single pricing method should be used for different transmission services and/or different regions in which transmission capacity services are supplied; and
- the implications of the above findings for prices, investment in and use of infrastructure, and competition across different regions.

Although the ACCC has previously considered some of these issues in the course of various declaration inquiries, exemption applications and arbitration hearings, and has commissioned a total-service long-run incremental cost (TSLRIC) model to assist it in performing its regulatory functions, it sought a 'first principles' review of its regulatory approach in this area.

Transmission capacity services have some characteristics that give rise to difficult pricing issues. As with many telecommunications services, the networks that provide transmission capacity services are capital-intensive and require large sunk investments. The network design also means that transmission capacity services can have relatively low incremental costs on a 'point to point' or route basis (in comparison to total network cost). This creates substantial cost allocation difficulties, and the mix of competitively supplied and non-competitively supplied routes accentuates this difficulty. The regulatory approach to the pricing of non-competitive (declared) services must account for these characteristics.

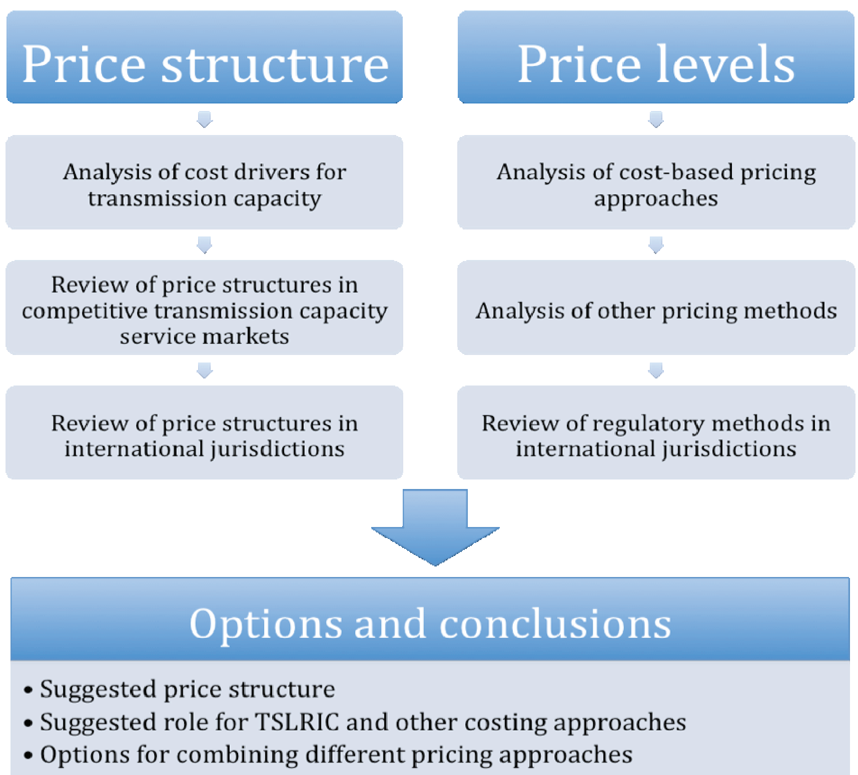
OUR APPROACH

As noted above, we have taken a first principles approach to the pricing of transmission capacity services.

We addressed the questions asked by the ACCC by breaking the task into two – the task of determining efficient price structures for transmission capacity services, and the task of determining how to set price levels for declared transmission capacity services.

This approach is described in more detail in Table 1.

Table 1 Approach to analysis



CONCLUSIONS ON PRICE STRUCTURE

Good price structures are those that encourage efficient consumption and investment decisions, but are (relatively) objectively determined and verifiable, simple and practical, and limit the possibility that Telstra or another vertically-integrated access provider will price in a way that favours itself in downstream markets.

Given the trade-offs that are inherent in some of these objectives, a degree of pragmatism will be necessary. The following key points can be made in relation to a suitable structure of transmission prices:

- There is a large difference between the short-run marginal cost and long-run incremental cost of a transmission capacity service (particularly when the 'increment' of output) is large.
- There is broad consensus that the main cost drivers for transmission capacity services in the long run are capacity and distance, although to some degree the 'interlocking ring' structure of transmission networks mitigates the effects of distance when analysing the costs of particular routes. This is supported both by overseas evidence and by analysis of prices charged on (more) competitive routes in Australia.
- Price structures that vary by both distance and capacity demanded should provide appropriate incentives for reasonably efficient use of infrastructure and efficient investment in infrastructure. The relationships between price and capacity should depend largely on the cost-volume relationship implied by differences in equipment costs for higher capacity services. The relationship between price and distance is less clear, but the relationship could be derived from price structures on competitive routes.
- As much as is feasible, prices should reflect cost causation – costs should be borne by those who cause the costs to be incurred, and reflect how they are incurred. For example, fixed costs (such as connections costs) should be recovered from fixed fees.

CONCLUSIONS ON PRICE LEVELS

We considered the arguments for adopting regulated pricing approaches that were not based on the access-provider's costs, such as benchmarking of international or domestic routes, 'retail minus' pricing, reliance on anti-competitive conduct laws (light-handed approach) and 'safeguard' price caps that seek to prevent price increases. We were not convinced that these approaches would be accurate enough (benchmarking), could be readily implemented (benchmarking, 'retail minus') or would really address the issue that prices were well in excess of cost ('retail minus', light handed approaches, 'safeguard' price caps).

We therefore found that some form of cost-based pricing should be used to price transmission capacity services where high prices were likely to be prevalent. Having said that, cost-based price regulation is a costly solution to deal with high prices. Transmission networks are very complex, and aside from the direct costs to industry of developing appropriate costing methods, there is also a reasonably high risk of getting access prices wrong, with the prospect of (a) setting prices too high and facilitating recovery of monopoly profits and encouraging inefficient bypass, or (b) setting access prices too low, damaging prospects for cost recovery and discouraging prudent investment by access seekers that would be highly beneficial in the longer term.

Taking this into consideration, our view is that it would be preferable to use different pricing approaches to account for differing degrees of competition. In particular, a non-cost based approach could be used where there has been some competitive entry. This would reduce reliance on cost modelling and encourage facilities-based competition.

For monopoly routes, our discussion of the costing options suggests that there is no costing approach that is more appropriate than the others in all circumstances; rather, a decision will need to be made based on the analysis of the characteristics of the costing approach considered most important to the ACCC.

Table 2 Applicability of costing approaches to transmission capacity services

Factor	Bottom up TSLRIC		Top down TSLRIC	CCA FAC	HCA FAC
	Narrow increment	Broad increment	Broad increment		
Granularity – ability to cost routes separately & minimise averaging concerns	High	Accounting approaches inherently have less flexibility than bottom up models, but broader bottom up modelling will also encounter this problem			
Potential for common cost over-recovery	High	Low - Accounting approaches *or* TSLRIC modelling of a broad increment can counter this problem			
Amount of work required before disputes / undertakings	Low	High – it will be too difficult to apply these approaches only once disputes arise or undertakings submitted			
Incentives for new investment	Costing approaches that do not re-value assets or optimise the network when costing are likely to best encourage investment, as they reduce the risk of asset stranding. However, these approaches do not best promote efficient 'build or buy' decisions by access seekers, and so can encourage inefficient bypass.				
Incentives for use of existing infrastructure	Costing approaches that re-value assets and optimise networks are likely to best encourage efficient use as these approaches take into account value of productive capacity required to meet access requirements.				
Certainty for access provider and access seekers	Low – as costing will be specific to particular dispute	Moderate – as costing information could be readily used in more than one dispute			
Consistency with other costing approaches	High – viz. mobile cost model and fixed cost model		ACCC has not tended to favour these approaches in the past		

In Table 2 above we summarise our views as to the relevant factors and the merits of each kind of costing approach.

The first factor (granularity) is a very important one, because bottom-up TSLRIC modelling would be better at producing estimates at the route or region level. Our view is that further aggregation of costing above the route level is necessary, primarily because it would increase the reliability of the costing (particularly with respect to common costs). It should also provide for greater certainty for access providers and access seekers, as the results of the costing will be more broadly applicable (i.e. to more than just the route that is the subject of dispute).

We consider the decision whether to use a forward-looking bottom-up costing approach is finely balanced. On the one hand, one might expect transmission capacity services might be subject to some inefficiencies in supply, which forward-looking modelling could counter. On the other hand, the possibility of bypass may be of little practical significance for certain transmission capacity services, particularly those in regional areas, and so there may be little benefit in choosing a costing methodology on the basis that it promotes efficient 'build or buy' decisions. Costing approaches based on historical costs and incorporating a price cap could equally provide for opportunities for the access provider to earn a return on investment, together with incentives to minimise costs (to a degree this will depend on how the 'X' in the price cap is set). Alternatively, a hybrid approach where bottom-up LRIC modelling results are reconciled with top down CCA modelling results could also help to ensure that the estimated costs better reflect the costs incurred by the access provider.

Our view is that using multiple sources of cost information to set prices would likely be the best approach. This could include a combination of bottom up TSLRIC modelling at an aggregated level with CCA regulatory accounting information, but could also include international and domestic benchmarks (this will depend on the specific route or service at issue). TSLRIC modelling may still be necessary to cost particular routes or regions separately if certain routes *or* regions are likely to have much higher costs of supply.

If the more aggregated approach to costing is considered appropriate, a decision must also be made as to *how* to best aggregate routes so as best to manage the trade-off between the benefits and problems of costing granularity. The basic principle is that aggregation should apply to all routes or services with similar cost characteristics. One approach would to cost all types of transmission services as the one service. A second approach would be to split services along the lines of the ACCC's basic classification Inter-capital, Capital-Regional, Inter-exchange and Tail-end). A third (intermediate) approach would be more akin to the European approach, with separates 'trunk' from 'terminating' transmission segments (roughly speaking, we understand this would involve grouping inter-capital with capital-regional as 'trunk' services, and grouping other inter-exchange and tail-end services as 'terminating' services).

Our judgement is that:

- The 'trunk' and 'terminating' approach to service aggregation is likely to prove easier to develop and apply than either the broader 'all transmission capacity services' approach or the narrower 'each service' approach to costing.

- If regulatory accounting data is to be used, consideration must be given to the disaggregation of Telstra's existing regulatory accounts. It will likely be too burdensome for Telstra to report regulatory accounting data down to the level of routes, but at the existing level of aggregation, the regulatory accounts provide no useful information for the purpose of setting or comparing prices. At a minimum, Telstra should be required to separately report costs and revenues for different types of transmission capacity services (e.g. trunk / terminating). Further geographical disaggregation for terminating services would also be desirable, and further vertical disaggregation of line items in the accounts will also be necessary to analyse the efficiency of proposed price structures.

- As any aggregated costing approach is likely to cover a mix of competitive and non-competitive services, there will need to be some means of allocating any shared costs between competitive and non-competitive services. Our view is that the approach of allocating the cost according to a relevant cost driver such as share to total capacity and/or share of total distance is likely to be the best in the circumstances. The allocation rules should be approved by the ACCC to ensure there is minimal opportunity to disproportionately load costs on to non-competitive routes.

1 Introduction

The Australian Competition and Consumer Commission (ACCC) has asked Frontier Economics (Frontier) to prepare a report on the economics of transmission capacity services pricing.

1.1 TRANSMISSION CAPACITY SERVICES

The ACCC describes declared transmission capacity services in the following way[1]:

> The domestic transmission capacity service (DTCS) is a generic service that can be used for the carriage of voice, data or other communications using wideband or broadband carriage (the minimum bandwidth in the current declaration is 2 Mbps). Carriers/carriage service providers (CSPs) can use transmission capacity to set up their own networks for aggregated voice or data channels, or for integrated data traffic (such as voice, video and data).
>
> There are a number of types of transmission capacity services, including:
>
> - inter-capital transmission
>
> - 'other' transmission (e.g. capital-regional routes)
>
> - inter-exchange local transmission
>
> - tail-end transmission.

It should be noted that, technically, 'bandwidth' as referred to in the service description above, refers to the capacity — that is, the data rate (e.g. Mbps or Gbps) — of the service provided. The terms bandwidth and capacity/data rate are often used interchangeably in the context of telecommunications transmission services. For the purposes of this report, the term capacity, rather than bandwidth, is used to refer to the data rate of the service.

The ACCC describes these different transmission services as follows:

- **Tail-end transmission**: this refers to transmission services provided within an ESA (exchange service area), and in the CAN (customer access network). This transmission occurs between a customer location and some point of interconnection (POI) on the access seeker's network. Where Telstra provides tail-end DTCS the transmission is between the customer location or POI and the Telstra exchange.
- **Inter-exchange transmission**: this refers to transmission services provided in a single call charge area (CCA) between a POI located at, or virtually co-located with, an access provider's local exchange. It occurs within an ESA (if there is more than one exchange in the ESA) and across ESAs. Inter-exchange transmission can be used for backhaul, where a major central site

1 ACCC, *Domestic Transmission Capacity Service: An ACCC Final Report on reviewing the declaration of the domestic transmission capacity service*, March 2009, p. 1.

(usually a trunk exchange in CBD areas of capital cities), will act as an aggregation point to manage traffic flow to and from outlying exchanges.

- **Transmission provided across different CCAs**: this refers to transmission services provided along inter-capital, capital-regional and inter-regional routes. Transmission on these routes is aggregated at a major central site, for instance at a trunk exchange (major exchange), to manage the transport of traffic to and from CCAs.

Transmission services have recently been the subject of applications for exemption from declaration, sought by Telstra, and a broader inquiry to determine whether continued declaration of services would be in the long-term interests of end-users (the object of Part XIC of the *Trade Practices Act 1974,* which provides for regulated access to transmission capacity services). These recent events have resulted in a withdrawal of access regulation from certain routes found to be competitive.

The amended service description essentially covers:

- a limited number of inter-capital routes (covering only services to and from Darwin and Hobart);
- a larger number of capital-regional routes (with exemptions largely covering areas between Melbourne, Sydney and Brisbane and various local centres);
- much inter-exchange transmission, although recent exemption decisions have removed regulation (from late 2009) in parts of Melbourne, Sydney, Brisbane and Perth; and
- tail-end transmission.

1.2 ACCC REQUEST

The ACCC's brief for Frontier requires that Frontier's report explore the following questions:

- How should efficient regulated prices for transmission services be determined? In particular, what pricing structures will create incentives for efficient investment in, and use of, transmission network infrastructure, and promote competition? For example, should prices vary by:
  - route
  - volume
  - geography (e.g. regional versus metropolitan, or nationally averaged)
  - the bundle of services purchased
  - customer type (e.g. corporate/Government versus access seeker using access network)
  - capacity
  - distance
  - service type (e.g. inter-capital, inter-exchange etc)
  - length of contract
  - the presence, or lack of, excess capacity.

- Should cost-based pricing approaches be applied in determining a regulated price for transmission services? If so, what cost base should be used (e.g. forward looking or actual costs)? And what pricing methodology (e.g. total service long run incremental cost (TSLRIC), retail minus, utility style) should be applied? Should separate cost bases and/or pricing methodologies be used for different services and/or regions?
- What are the implications of the above findings for prices, investment in and use of infrastructure, and competition across different regions (metropolitan and regional)? Further, what are the incentives created by geographically averaged prices coupled with the incremental deregulation of competitive routes?

1.3 STRUCTURE OF THE REPORT

In our report, we address the ACCC's questions as outlined in Section 1.2 above. We address these questions from 'first principles' – meaning that where possible we have abstracted from questions of implementation of pricing approaches under the existing Part XIC access regime in the *Trade Practices Act 1974*. The ACCC will obviously be constrained from implementing particular pricing regulations by its legal powers, but we have left these issues for the consideration of the ACCC.

In Section 2 of this report, we briefly outline some of the key features of transmission networks for pricing purposes and describe the economic and implementation issues relating to pricing as they have arisen.

In Section 3 of this report, we review the literature on the efficient price structures for access services, and examine the appropriate relationship between cost structures and price structures for transmission services.

In Section 4, we consider the theoretical and practical merit of different applications of cost- and non-cost-based methods of regulation to transmission capacity services.

In Section 5, we develop some options for regulation and make recommendations on the approach that is likely to be the most appropriate in this context.

2 The pricing of transmission capacity services

In this Section, we briefly outline some of the key features of transmission networks for pricing purposes and describe the issues relating to pricing as they have arisen.

2.1 STRUCTURE OF TRANSMISSION NETWORKS

To understand the nature of the issues in pricing transmission capacity services, it is useful to first outline some of the structural features of transmission networks.

2.1.1 Rings and ladders[2]

The ACCC's decision on Telstra's application for DTCS exemptions suggests that transmission networks are "generally configured to efficiently manage traffic flows and minimise the risk of transmission failure."[3]

These considerations give rise to transmission networks having two main characteristics. First, transmission networks have traffic centralisation at key central sites or transmission hubs. Second, path diversity allows for increased aggregation of traffic (at points along a route) and ensures continuity of service. These two characteristics mean that Telstra's transmission network can be described as a series of interlocking rings. It also has a number of 'tails' or 'spurs' which are connections between the core transmission network and particular (business) premises.

We understand the approach of new entrants building transmission networks has been slightly different from that of Telstra. Entry has tended to focus on inter-capital routes where there is already diverse capacity (i.e. Telstra's), and has largely involved building of single paths (non-diverse capacity). However, new entrants may provide diversity on the same geographic route, in a ladder structure, by using multiple fibres within the same cable, or separate cables.

Although there is some use of ladder topologies on competitive routes, our understanding is that non-competitive routes (with the likely exception of tail end transmission services) will largely be part of ring network topologies. Any regulatory intervention into pricing will need to account for these design characteristics in some way.

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2 Note this Section largely summarises our understanding of a presentation and discussions with ACCC technical adviser, Mr Jim Park.

3 ACCC,*Telstra's domestic transmission capacity service exemption applications*, Final decision, November 2008, p. 16.

2.1.2 Competitiveness of different transmission capacity services

Entry by firms supplying transmission capacity services means there is competition in some markets in which these services are provided. Mostly this competition occurs for the supply of inter-capital services, as these have proven the most lucrative routes. We understand there has also been some entry to supply inter-exchange services (within a CCA) and inter-regional services (across CCAs). The ACCC has been progressively removing access regulation from more competitive routes since 2001. However, our understanding from the ACCC's most recent review of the DTCS declaration (March 2009) is that there has been little entry to supply tail-end transmission services.

The remaining declared routes are widely seen as having high prices, even though they have been subject to regulation since 1997. While disputes about the pricing of transmission capacity services have been taken to the ACCC for resolution, we understand there have been no interim or final arbitral determinations. It is not clear to us why there have been so few disputes given the perception of high prices. It may be that this reflects underlying weaknesses with the 'negotiate-arbitrate' regime – in that it might not be worthwhile for one party to follow through with a dispute, even if the benefits to all access seekers of taking that dispute would outweigh the costs. Further, there may be difficulty in parties co-ordinating to raise a dispute.

Our view is that removing regulation where services are competitively supplied is consistent with good regulatory practice. Equally, where services are unlikely to be subject to competitive supply (described by the ACCC as "enduring bottlenecks") pricing regulation should continue to apply.

2.2 OVERVIEW OF TRANSMISSION CAPACITY PRICING PROBLEMS

Telstra's network supplies services in both competitive and non-competitive markets (i.e. costs are incurred that support more than one service) making it complex to set prices based on any approach that allows recovery of these common costs. The problem is compounded by the fact that there are common costs between these transmission services and other services (such as services provided over Telstra's CAN).

As suggested by the ACCC in its consultancy brief:

> The complexity of transmission networks and the way services are sold makes determining a regulated price that creates incentives for efficient investment in, and use of infrastructure, and promotes competition, complex.

This problem is seemingly borne out by modelling of the cost of serving particular routes, as per the GQ-AAS TSLRIC model. Bottom-up incremental cost models, including TSLRIC models, are generally developed according to the following general process:

1. Forecast the expected service demand;

2. Dimension a network which efficiently meets that demand now and allows for reasonable demand growth;
3. Cost the network elements of a dimensioned network;
4. Annualise the capital costs of the network and estimate operating and maintenance costs;
5. Allocate the costs to the services that use the relevant network elements;
6. Allocate common costs; and
7. Divide the costs by the relevant service demand (e.g. minutes of use, number of lines) to unitise costs into prices.

Applying such a model by defining routes as incremental services is difficult – although not impossible – because the results will be critically dependent on the demand and cost allocation assumptions used. All of these require consideration of a broader set of services than just a particular route.

As described above, demand information is used to determine the efficient network capacity, to allocate network element costs to services, and to calculate unit costs. The sharing problem arises in relation to efficient capacity because the demand information for a particular route cannot be used to dimension the network where that route shares traffic with other routes. For example, a point-to-point route with 10Gbps demand might in fact require 40Gbps capacity if the route is shared with a number of other routes (as is common with an interlocking ring structure). Sharing of network elements by more than one service and/or route is also relevant to how common costs are allocated to a route, and calculated cost differs dramatically depending on sharing parameters, for example, with different degrees of sharing assumed of trenches, cables, fibres and services.

What problems follow from this costing difficulty? The two basic problems can be explained with reference to a ring structure diagram that characterises in a simplistic way much of Telstra's network (see Figure 1 below). Suppose that route A to B is a monopoly, but route B-C is competitive and not regulated. Suppose further that the total cost of providing a service A-B is 20, and that 15 of this cost would only have to be incurred once – to provide A-B and a redundant path A-City-D-C-B (i.e. which also includes route B-C). Suppose further that the incremental costs of B-C (i.e. the cost of producing B-C *in addition to* A-B) are 5. In that case, if one costs only A-B without considering B-C, the cost will be equal to 20, but the total cost of producing A-B and B-C will only be 20 + 5 = 25. Allowing recovery of 20 for service A-B may lead to cost over-recovery (this is actually the 'stand alone' cost of service A-B[4]).

The existing GQ-AAS model recognises this difficulty by modelling ring structures and allowing for parameters to be inputted reflecting differing degrees of sharing. However, if one allocates too little fixed and common cost to the regulated route, then it is likely that insufficient returns will be earned overall (as

4 See Section 4.2.2 for a further discussion of stand-alone costs.

only competitive returns could be earned on the competitive B-C route). In contrast, if too much common cost is allocated then the route methodology would allow Telstra to earn excessive returns on the system as a whole. Neither outcome would likely be consistent with efficient use of, or investment in, infrastructure. We discuss the principles of efficient pricing in more detail in Section 3.

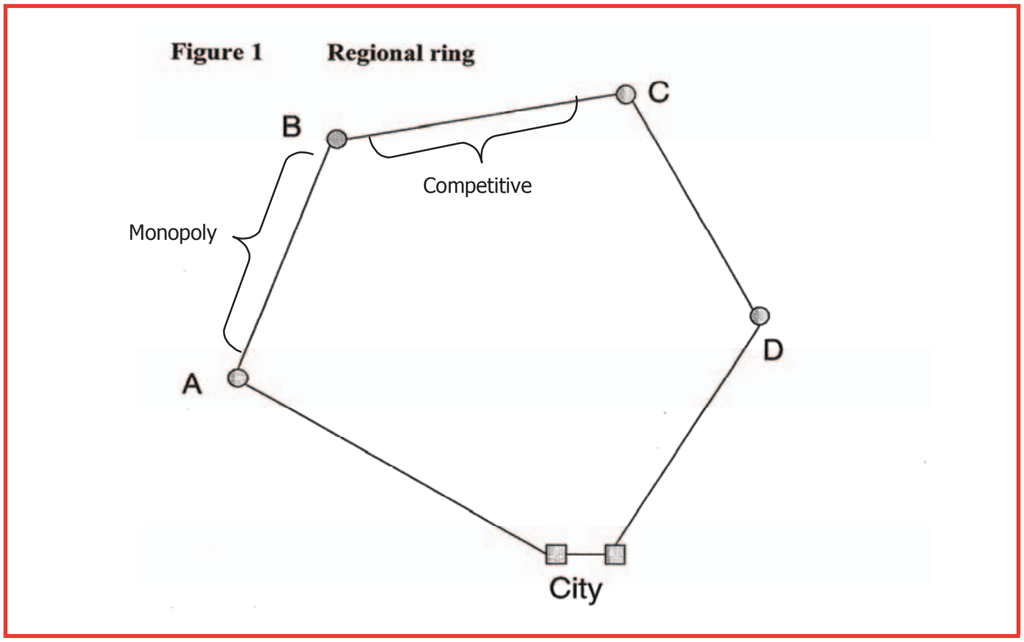

Figure 1: Representative transmission ring

Source: ACCC

A second and related pricing problem is that even when one costs a ring as described above, these costs need to be converted to prices for each service on a ring. Because the ring structure means that an access seeker purchasing an A-B service also purchases an A-City-D-C-B service (for redundancy), it may be thought that prices could be set solely on the basis of how much capacity the service 'consumes' on the ring. However, prices may also need to take into account the (direct) route distance. Suppose that there was no difference in prices based on distances travelled (for example, so that service A-B was priced the same as service A-D). The issue is that the price for route A-B would reflect the costs of recovering fibre laid along A-B *and* along A-City-D-C-B, which might push prices to a level where they attract duplication of the A-B route by competitors, which may be neither efficient nor reflect the way this service would be priced in a competitive market. The likely influence of distance as a cost driver in transmission networks (relating to the costs of digging trenches and laying fibre) is further discussed in the following Section.

Note that the problems we have described above appear intrinsic to any costing approach that seeks to cost particular routes (i.e. that is, they are not particular to the TSLRIC approach).

3 Efficient price structures for transmission capacity services

In this Section of our report, we set out how prices may be structured to maximise economic efficiency – to create incentives for efficient investment in, and use of, transmission network infrastructure.

We first look at why prices need to be modified from 'first best' in industries with strong economies of scale and scope, and how distortions from 'second best' pricing solutions may be minimised. We then consider the cost drivers for transmission services, and evidence from other jurisdictions on how prices for transmission capacity services are structured.

3.1 MARGINAL COSTS

Any discussion of efficient pricing must necessarily start with the consideration of (short run) marginal costs. Marginal cost is the increase in total costs that arises from a decision to produce an extra unit of output. This definition can be found in all introductory textbooks of microeconomics.[5] Economics always defines costs in terms of opportunities that are forgone as a result of particular decisions. That is, one can only specify what is meant by a cost, if one is quite precise about *what decision* is being made.

The marginal cost is the value of opportunities that are forgone as the result of a decision to increase the rate of output by one unit. The idea behind the rule that prices should equal marginal costs (the 'first best') is that this will ensure that the decisions (as to how much output to produce) made by individual producers in maximising their profits will also be consistent with economic efficiency in the sense of maximising the value that can be generated by the resources that are available to society at large.

There are, however, two main reasons why pricing at the marginal cost of an extra unit of output may not be optimal:

- to recover fixed costs; and
- to recover common or joint costs.[6]

Both of these costs are found in effectively competitive markets, but are more significant in industries with large economies of scale and scope.

3.1.1 Fixed and sunk costs

Marginal costs are the extra opportunities that are forgone as the result of a decision to produce an extra unit of output. If this decision assumes a given

5 See, for example, J. Gans, S. King and N. Mankiw, *Principles of Microeconomics,* Thomson, 2nd ed, 2002, p 271.

6 Other reasons from diverging from marginal cost include externality considerations, but this does not appear to have any bearing of the efficient pricing of transmission capacity services.

telecommunications infrastructure, the costs incurred in building that infrastructure will not be included in marginal costs. These costs will not vary as a result of a decision to produce an extra unit of service. The costs incurred in building the infrastructure are said to be fixed with respect to that decision. If prices are set equal to marginal costs, the fixed costs of building the network will not be recovered.

Many fixed costs, particularly in transmission networks, are also considered to be sunk costs. Sunk costs are those costs that have no positive resale value, i.e. they become specialised to a particular use and have a zero opportunity cost. They are important to pricing because while they can effectively be ignored in pricing decisions relating to use of existing assets, no firm will ever 'sink' costs unless they have the expectation that they will be able to earn a return on these sunk investments. That is, if the decision is whether to continue investing so as to ensure ongoing supply of service into the long run, then such costs will be relevant to that decision. This provides an efficiency rationale for a firm to price based on the *long run* marginal costs of providing a service.

3.1.2 Multi-output firms and cost allocation

A second reason for deviation from first-best pricing rules arises where a firm produces more than one service using the same set of assets. In these circumstances, the sum of marginal or incremental costs of each service will be below the total cost of producing all of the services. Each individual calculation of marginal or incremental costs (whether long-run or short-run) will ignore the costs that are common to all of the services. These costs must be recovered for the regulated firm to remain viable.

As we described in Section 1, the high potential for the sharing of assets and infrastructure across routes and the high level of fixed costs means that cost allocation can be a major issue for the efficient pricing of transmission services.

3.2 SECOND BEST APPROACHES

In the previous Section, we described two reasons why pricing all units of output at (short run) marginal cost is not likely to be appropriate for regulated transmission services.

There have been many attempts in the economics literature to develop 'second best' pricing approaches which mitigate the losses in economic welfare from the need to price services above short-run marginal costs. These provide some basic insights (which we summarise below), but much of the more recent literature provides pricing solutions that tend to be theoretically elegant but difficult to apply given (a) asymmetric information between regulator and regulated firm[7], and (b) where vertical integration reduces the pricing flexibility that a regulator

7 This particularly applies to approaches such as the 'global price cap' of Laffont and Tirole, *Competition in Telecommunications*, 2000, Chapter 4 (discussed further in Section 4). This approach would require regulation of retail prices as well as wholesale access prices.

might otherwise give the access provider, for fear of that pricing flexibility being used against access seekers.

Regulators, operating from a more pragmatic perspective, have also adopted approaches which allow for cost recovery but also take into account broader considerations, including how well the pricing approach promotes competition, equity between access seekers, transparency and ease of implementation.

3.2.1 Average cost pricing

It is straightforward to demonstrate that if a firm wishes to have a single price, then the only price that will allow cost recovery for a firm with declining marginal costs over some region is average cost. However, if the firm produces two or more goods, the second-best outcome is not immediately obvious. For a multi-output firm, there are many pricing combinations that can lead to cost recovery. For example, a firm selling both A and B could elect to recover common costs associated with their production by marking up A alone (leaving the price of B at marginal cost), marking up B alone, or via some combination. Of these many combinations, the one that provides the highest economic welfare (sum of consumer plus producer surplus) is the second-best outcome.[8] This has been formalised under the concept of Ramsey pricing.

3.2.2 Ramsey pricing

Ramsey pricing is commonly considered to be the 'optimal' pricing approach to the second-best problem of marking up marginal costs to recover fixed and common costs.[9] Ramsey pricing involves allocating a greater proportion of fixed and common costs to customers whose demand is less responsive to price, (i.e. price elasticity of demand is low or relatively inelastic). The quantity of the product consumed by these customers will change less in response to the higher price than other customers, minimising the economic loss, in terms of under-consumption, from diverging from marginal cost pricing. Those customers that are most responsive to changes in price (i.e. price elasticity of demand is high or relatively elastic) face a price that is closer to marginal cost.

As Baumol and Bradford point out, the theorem:

> …seems to say that ordinary price discrimination might well set relative prices at least roughly in the manner required for maximal social welfare in the presence of a profit constraint.[10]

There is still a great deal of judgement that needs to be exercised in determining Ramsey-optimal prices. The judgements include information on the demand-side – information that is usually only available to the regulated firm, if at all. Other

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8 See Train, *Optimal regulation: the Economic theory of Natural Monopoly*, 1991, p.17.

9 The problem of finding the best linear prices was first solved by Frank Ramsey (1927), then Marcel Boiteux (1956), and Baumol and Bradford (1970). See Baumol and Bradford, "Optimal Departures from Marginal Cost Pricing," *American Economic Review* Vol 60, no 3 (June 1970) pp 265-283 for a discussion of the theorem and the history of the literature.

10 *ibid.*, p 267.

decisions must be made about appropriate price structures, as linear Ramsey prices will not be optimal where non-linear pricing structures such as two-part tariffs could be used (as discussed below).

Although Ramsey-pricing is complex, and difficult for a regulator to implement effectively, certain types of regulation (such as price caps where the basket is sufficiently broadly defined and sub-caps are not too restrictive) allow the firm to implement a Ramsey-based solution.

3.2.3 Two- and multi-part tariffs

Two part tariffs (consisting of a fixed access charge and a variable usage charge) can be shown to improve on linear prices (in terms of minimising loss in economic welfare) as they enable marginal prices to get closer to marginal costs while helping to cover fixed costs. Indeed, it is actually possible for a two-part tariff to achieve first best outcomes if fixed costs can be completely recovered by fixed fees, and usage is charged at short-run marginal cost.[11]

The interesting feature with two-part tariffs, and a great difficulty with implementation in access pricing setting, is how to set the fixed fees. Gans and Williams describe this as follows:

> The determination of fixed fees has always been a contentious issue in regulation. In the past, its choice has been seen as arbitrary – essentially, redistributing income from access seeker to provider – without any real efficiency consequences. However, from the point of view of market participants, the level of fixed charges is a contentious issue. This is because providers realise that it affects the overall return on their investments and access seekers realise it influences their incentives to enter markets and compete with incumbents.[12]

The obvious fixed fee solution (as suggested by Coase) is just to set the fixed fee as an equal amount per access seeker (including the access provider, if it also operates in the downstream market). However, the number of customers may well be endogenous (i.e. depend on the size of the fixed fee set).

An alternative approach to setting fixed fees would be to follow Ramsey principles in order to minimise distortion. This would mean that customers with the least elastic demand (for its downstream services[13]) would bear more of the fixed cost.[14] However, it is unlikely that such an approach would best promote competition and economic efficiency, whether fixed prices were set by the operator or the regulator:

- If the access provider was left to determine these fixed fees (subject to an overall cap), there would be significant concern that the fees would be set to lessen competition in the downstream market by discouraging efficient entry.

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11 This result is first attributed to R. Coase, "The Marginal Cost Controversy", *Economica*, 13: 169-82.

12 J. Gans and P. Williams, "A primer on access regulation and investment", in ACCC / PURC, *Infrastructure Regulation and Market Reform*, May 1998, p. 151.

13 See e.g. Laffont and Tirole, *op.cit.*, p. 81.

14 See R. Sherman, *The Regulation of Monopoly*, 1989, p. 146

Such concerns would, of course, be mitigated if there was no vertical integration (and hence little to gain from price discrimination that inhibited entry).

- If the regulator was to set prices, the informational demands would likely be too great for such an approach to be feasible.

3.2.4 Longer run pricing considerations

In regulatory settings, regulators commonly allow firms to price on the basis of long-run costing concepts, such as long-run marginal or incremental costs. The efficiency justification for this type of pricing is that it explicitly allows for consumers to face the costs of maintaining and expanding service capacity over time.[15] These prices will generally be higher than short-run marginal or incremental costs, because they allow the firm to recover fixed and sunk costs (including depreciation costs and a return on capital invested). This is particularly important in situations where future investments must be made to maintain and expand productive capacity, and where infrastructure-based competition is potentially feasible in the longer-term.

3.2.5 Conclusion

In conclusion:

- it is desirable to ensure that access prices at the margin are as close to short run marginal cost as is feasible, while also taking into account the need for overall cost recovery (including a return on capital invested);
- where fixed costs are significant (and they usually are in communications infrastructure), fixed fees that recover these costs would promote better efficiency outcomes;
- long-run marginal or incremental cost pricing will allow the firm to recover fixed and sunk costs, but will need to be augmented to ensure recovery of common costs both within transmission services and between transmission services and other network services; and
- access prices which allow for a regulated firm to set prices on the basis of demand as well as cost information can promote more efficient recovery of fixed and common costs. However, if the access provider is vertically integrated, it may have incentives to use its pricing discretion to lessen competition.

3.3 COST DRIVERS AND OTHER PRICING INFLUENCES

The ACCC has requested that we examine the key factors that may influence efficient price structures for transmission services. It would be expected that for pricing to be conducive to efficiency, price structures would need to be set to reflect cost structures – that is, costs should be recovered from those whose

15 See e.g. A. Kahn, *The Economics of Regulation*, 1988, pp.88-89.

actions cause the costs to be incurred at the margin. This is particularly important in telecommunications because the marginal costs of providing capacity (bandwidth) for services is a relatively small proportion of total cost (even in the longer run).

In a perfectly competitive environment, setting prices that are not cost-reflective is unsustainable. A firm operating in a competitive market that sets prices that average across areas or product spaces would find that competing firms will be able to undercut its prices in the lower cost areas ("cream skimming"). In higher cost areas, the firm will make sales, but these will be at a loss. Hence, "competition is the enemy of cross-subsidies". [16]

This does not mean firms always set prices to reflect *any and all* differences in costs, even in quite competitive markets. Two factors that are also relevant to pricing decisions are:

- the size of the cost difference (the smaller the differential the less likely it is to be taken into account). Due to the high fixed and sunk costs of entry, markets for transmission services are far from perfectly competitive and prices may deviate far from marginal costs before entry occurs; and
- whether the product or service can be differentially priced (from a commercial perspective, such as consumer acceptance or the pricing strategies of competing firms).

A further complicating factor is that, as we discuss above, in most situations 'second best' efficient prices are determined by considering both demand and cost conditions. Differences in some of the factors referred to by the ACCC may be thought of as affecting costs only, and differences in others may reflect differences in demand (with different associated elasticities of demand). However, to the extent that they do not have a *major* impact on costs or have a *major* influence on demand for transmission services, the benefits of accounting for them may be more than outweighed by the costs of designing and administering a pricing regime to take them into account.

In the following three Sections of our report, we identify the main cost drivers for transmission services, identify how they are likely to influence costs and therefore prices and then review pricing structures that are used in overseas jurisdictions.

3.3.1 Specific pricing factors

The ACCC has sought advice on whether transmission prices should vary by the any of the following factors:

16 Attributed to White, see .e.g. J. Farrell (speech), *Prospects for Deregulation in Telecommunications,* 1997, available at http://www.fcc.gov/Bureaus/OPP/Speeches/jf050997.html

- route
- volume
- geography (e.g. regional versus metropolitan, or nationally averaged)
- the bundle of services purchased
- customer type (e.g. corporate/Government versus access seeker using access network)
- capacity
- distance
- service type (e.g. inter-capital, inter-exchange etc)
- length of contract
- the presence, or lack of, excess capacity.

Some guidance on the structure of pricing can be informed by the major cost categories applying to transmission services, and what these are sensitive to. The major cost categories are considered in turn below.

Civil works (trenching and ducts)

Trenching, particularly where it involves construction of tunnels or digging and the installation of ducts as opposed to ploughing, tends to be one of the largest components of the costs of transmission networks. The cost of this trench is sensitive to geographic location (most expensive in central business districts - CBDs, less so in metropolitan areas and towns and least expensive in open country areas) and is strongly dependent on distance. Opportunities for sharing trenches with other utilities and services (including other parts of the network) can substantially lower the costs of trenching that are borne by transmission services. This is most likely to occur in more built-up areas.[17] Trenching costs can be considered largely invariant to transmission capacity or demand.

Fibre cables

Fibre is a key dedicated input into transmission services. It is however not a particularly expensive component in itself, but the costs of installation do add significantly to the cost. Due to fibre's low costs and high capacity range, its cost tends to be invariant to capacity or demand over a very large range. While the cost of fibre and its installation cost is strongly related to distance, the low cost of fibre cable in the overall costs of transmission and lower installation cost than for trenches (less so for undersea routes) means that the relationship of fibre length to the cost of transmission services is not considered to be as strong as for trenching.

Optical equipment

Excluding civil engineering costs, the cost of optical equipment to transmit and receive optical signals can account for the single largest cost for transmission

17 Some discussion of this is provided in GQ-AAS, *ACCC transmission network cost model - description of operation*, 2008, p. 15.

services. Unlike trenching and fibre, it is sensitive to capacity.[18] However this relationship is less than proportional. In relation to systems of different capacity GQ-AAS state for example:

> We understand that the cost of the components of the 10Gbps systems are very close (if not quite the same) to that of the 2.5Gbps systems.[19]

More generally we are advised by the ACCC that an engineering "rule of thumb" with respect to optical equipment is that increasing capacity by 4 times, leads to costs increasing by only 2.5 times.

For a route with a given capacity, for example, 2.5Gbps, the multiplexing that is required to divide this capacity into smaller capacity for example 2, 8 Mbps etc, is proportionately greater the smaller the capacity required. This is as a result of the costs of the multiplexer, tributary cards and ports not falling proportionately with the speed of the services offered. This can help to explain, along with other fixed infrastructure costs such as trenching and cabling, why it is common to observe that the price of transmission services increases at a diminishing rate with respect to capacity.

The cost of optical equipment is also sensitive to distance in respect to longer transmission routes, which require the installation of repeaters every 80-90 km to maintain service integrity.[20]

Operations and maintenance

Operations and maintenance costs vary with the number of transmission circuits and distance in the longer run. In the case of long- distance routes, the number of repeaters and the impact of travel times means that the cost of operations and maintenance rises somewhat with distance.

Accommodation and power

Accommodation costs include exchange space for the optical equipment and associated exchange auxiliaries including air conditioning. Electrical power is required for the optical equipment and exchange auxiliaries.

Accommodation costs will be higher the more buildings that a service must pass through, which is a function of both the distance and the location of the route.

Accommodation and power costs will also vary with the number of circuit connections on the basis that the installation of more multiplexing equipment will use more space and power. These cost are also driven by capacity on the basis that higher capacity services may require more space and power.

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18 It is noted by Oftel for example that "the capacity of the MUX employed by PPC [partial private circuit] grows with its bandwidth". See Oftel, *Partial Private Circuits, Phase Two – A direction to resolve a dispute concerning the provision of partial private circuits*, 23 December 2002, p. 19.

19 GQ-AAS, *op. cit.* p. 6.

20 GQ-AAS, *op. cit*, p. 9.

Connection

There are discrete and identifiable once-off costs involved in connecting up a wholesale customer in order to provide it with a transmission service. Notwithstanding the possibility that it has an interest in overstating the tasks involved, Telstra has listed the connection components for an end-to-end transmission service as likely to comprise:

> ..service ordering, design, activation, work coordination, service qualification testing and cross connection, testing and updating database of records.[21]

Costs are primarily driven by the number of circuits installed.

Financing costs

The opportunity cost of capital invested in assets used to provide transmission capacity services is another significant cost. This cost of capital reflects both the total level of investment plus the level of risk associated with a firm investing in transmission services compared to other investments. Due to the capital-intensive nature of transmission services, the cost of capital is expected to account for a significant component of transmission charges. It will vary with the capital costs of particular transmission assets such as trenches, cables and optical equipment, and so will share these cost drivers.

Cost category	Cost driver/s
Civil works / trenching	Primary: Distance of route, Terrain / Geography
Fibre cables	Primary: Distance of route Secondary: Number of cables (capacity)
Optical equipment	Primary: Number of circuits and capacity Secondary: Distance (need for repeaters, etc.)
Maintenance	Primary: Equipment installed/circuits Secondary: Distance
Accommodation and power	Primary: Distance of route, stops on route, location Secondary: Number of circuits, capacity
Connection	Primary: Number of connections Secondary: Capacity
Financing (cost of capital)	Primary: Project risk Secondary: Distance, capacity

Table 3: Cost categories and cost drivers

21 Telstra, 2008, *Transmission cost model: Telstra Submission on Final Model*, July, p. 9.

A summary of these findings is presented in the table above.

Other factors that may affect prices

In reference to the ACCC's list above, there are a number of other potential factors that might affect efficient pricing structures:

- volumes of transmission services supplied on a route, or purchased by an individual wholesale customer;
- bundling of transmission services with other services (including other transmission services);
- different end-users to which transmission services are ultimately sold;
- length of contract; and
- excess capacity or excess demand (congestion).

Broadly speaking, where these factors produce identifiable cost differences it would be appropriate for these to be reflected in pricing differences. This is an outcome that could be expected to occur in a competitive market. In these cases, lower per unit costs might be driven by factors including economies of scope and scale or lower levels of uncertainty. Some examples of these factors are outlined below:

- In relation to service volumes, this will have a key bearing on the unit costs of transmission services for a given service, route or route aggregation in the presence of economies of scale. Discounts with respect to individual customers depending on volume purchased may reflect some economies in wholesale marketing and account management, but we do not consider this to be one of the more significant cost categories for the access provider.
- Bundling of wholesale services could justify discounts if there are savings on costs such as account management and wholesale marketing (again, which appear unlikely to be large). There could also be a price discrimination element involved, say through the recovery of common costs on more price inelastic wholesale services, which is a demand justification rather than a cost justification (discussed further below).
- Length of contract can have a bearing on the level of commercial uncertainty faced by the access provider in supplying a service. A longer contract would provide a more certain revenue stream and so would tend to lower the risk of investing in wholesale service related equipment and reduce frequency of marketing and recontracting costs, and hence could justify lower prices than for shorter contracts. This is a feature of some of the published commercial rates for high speed transmission in the United States (see Section 3.4.3 below).

Price discrimination on the basis of demand characteristics (e.g. the end use to which the service is put) can improve efficiency outcomes over uniform rate structures. However, price discrimination can also be used by a vertically or horizontally integrated access provider as a means of discriminating against new entrant access seekers (for example by applying volume discounts for its selfsupplied larger volumes, or to engage in predatory pricing in a competitive market by loading common costs onto services sold in non-competitive markets). For these reasons, incumbent operators are often required to not offer volume discounts (non discrimination) and/or not to bundle products.

Further, charging different transmission prices for different customer types or end-users of the transmission services would seem to be undesirable on the basis that (a) the wholesale purchaser is likely to have a better understanding of the demand conditions in retail markets than the access provider; and (b) it is not clear that the access provider would be able to enforce such price discrimination given that transmission services can be put to a multitude of end-uses.

At a practical level, a question also arises as to whether the information is available to the ACCC to take account of the complete range of drivers of potential pricing differences. On this basis we think that it is most sensible to focus on the sources of major cost differences that we believe include service type, aggregate volumes, capacity and distance. Other pricing differences, to the extent considered desirable, might be better left for commercial negotiation.

Excess capacity and congestion

The infrastructure used to provide transmission services may well have significant excess capacity. This may be seen as an inefficiency (and there may be a desire to exclude these costs from regulated prices), but this is not necessarily so. As we noted in our previous advice to the ACCC on this issue, there is a significant difficulty in looking at firms' investment decisions *ex post*. Access providers make decisions about capacity well in advance of that capacity actually being used, and the access provider knows that the incremental cost of adding capacity later (such as adding new fibre to trenches or additional multiplexing equipment to exchanges) can be very costly relative to adding it to begin with. The decision will therefore be weighted towards adding the capacity in advance, even if there is a relatively small probability of that demand actually materialising. This means that it transpire that the capacity is not used, but that it may have been prudent and efficient to allow for it in case it was required. In competitive markets, one might expect that this risk would be borne by the access provider – if demand is 'low', it might not recover the value of the excess capacity, but if the demand is 'high', it would earn sufficient profits to compensate for the risk of a 'low' outcome. However, if returns are regulated, and no 'excess' returns are allowed if demand turns out to be 'high', it would seem inappropriate to allow cost recovery only if the 'high' demand outcome eventuates (i.e. is observed *ex post*). Such regulation could deter the access provider from making efficient capacity investment decisions.

It is unclear to what extent we may see situations of excess *demand*. In theory, some form of congestion pricing may be appropriate to ration scarce capacity. However our understanding from discussions with the ACCC is that there is rarely likely to be excess capacity on a given fibre route that is not able to be met by adding extra electronics to the route to be able to 'light-up' fibre or to add extra wavelengths. Therefore, congestion is unlikely to arise in practice.

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3.5 PRICING STRUCTURES IN OTHER JURISDICTIONS

We have reviewed the structure of regulated transmission charges for a number of different services in the UK, Ireland, the US, Canada and New Zealand. In almost all the jurisdictions examined, inter-exchange transmission charges are structured with an upfront provisioning charge (which may or may not differ depending on capacity) and ongoing charges that vary with capacity and distance. Typically, the capacity charges are non-linear with respect to increases in capacity (i.e. the rate of price increase falls with the rate of increase in capacity). In regard to high speed access lines charges, there are examples of these differing by density zone, such as in the US and Canada and in the UK with respect to central London, but it is not common for these to vary with distance on a per kilometre or per mile basis.

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23 See e.g. http://www.pipenetworks.com/library/brochures/IntercapitalBandwidth.pdf

Table 1 below provides a high-level summary of our findings in relation to the international charging structures for regulated inter-exchange transmission services.

Country	Connection	Capacity	Distance	Other to note
UK	✓	✓	✓	
Ireland	✓	✓	✓	
US	✓	✓	✓	Contract term discounts apply
Canada	✓	✓	✓*	
NZ	✓	✓	✓	

Table 4: Structure of inter-exchange transmission charges

* A geographic "band" structures is used for some charges, such as Ethernet network paths.

Some further specific details for the different countries are outlined below. Details of the scope and nature of wholesale transmission pricing regulation is discussed in Section 4 of this report. Annexe A provides a consolidated summary of the services regulated, the type of wholesale regulation applied and the structure of wholesale prices.

3.5.1 United Kingdom

The following wholesale transmission markets are subject to regulatory obligations in the UK: [24]

- low bandwidth traditional interface[25] symmetric broadband origination (TISBO below 8Mbps);
- high bandwidth TISBO (between 8Mbps and 155MBps);
- wholesale trunk segments at all bandwidths; and
- alternative interface[26] symmetric broadband origination (AISBO) at all bandwidths.

Our understanding is that TISBO and AISBO services are similar in nature to what the ACCC refers to as tail-end transmission.

The table below summarises BT's current charging structure for PPC products. It can be seen that prices vary by both capacity and distance. While BT is permitted to offer geographic discounts for TISBO services these are permitted

24 Ofcom, *Review of the retail leased lines, symmetric broadband origination and whole trunk segments market, Final statement and notification*, published 24 June 2004.

25 ETSI interfaces at the standard speeds of 2,4,8,16,34/45 and 155mbps.

26 Such as Ethernet, with standard speeds of 10, 100 and 1000mbps.

to contribute to meeting its charge control obligations. In practice, BT only offers discounted prices in the Central London Zone (CLZ) where costs are lower and there is more competition. BT is not permitted to offer volume discounts.

Pricing element	Traditional interface	Alternative interface	Capacity related	Distance related
Circuit connection	✓	✓	✗	✗
Circuit Rental				
Local end fixed charge	✓	✓	✓	✗
Main link fixed charge	✓	✗	✓	✗
Main link per km charge	✓	✓	✗	✓
Third party customer link infrastructure charges	✓	✗	✗	✗
Point of handover charges				
Connection	✓	✗	✓	✗
Rental	✓	✗	✓	✗

Table 5. Summary of BT's current charging structure

Source: Ofcom[27]

3.5.2 Ireland

In Ireland, terminating segments of wholesale leased lines are subject to *ex ante* regulatory obligations whereas wholesale trunk segments are not.

Eircom's reference interconnect offer (RIO) for network services sets out the structure of wholesale transmission services.[28] Charges are split into connection fees, fixed rental fees and per kilometre charges. Terminating segment prices do not vary by location.

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27 *Leased lines charge control, a new charge control framework for wholesale traditional interface and alternative interface products and services*, published 8 December 2008, available at: http://www.ofcom.org.uk/consult/condocs/llcc/leasedlines.pdf

28 The RIO is available online: http://www.eircomwholesale.ie/dynamic/pdf/netpricelist%20Unmarked%20v2.7.pdf

3.5.3 United States

In the United States, under current Federal Communication Commission (FCC) rules incumbent carriers must offer a range of transmission services as unbundled network elements to competitors. The type of regulation applied differs depending on the services and the level of competition or "impairment" of competitors.[29]

We have found a number of examples of the price structures for transmission-type services sold by incumbent carriers, including:

- AT&T California 10Gbps "DecaMAN" intra-LATA (inter local access and transport areas) dedicated high capacity transport service comprises upfront charges, monthly fixed and monthly per mile charges. Separate diversity and protection charges apply. Rates are lower the longer the contract commitment. (AT&T 2009).
- Verizon New York's inter-office transport mileage tariffs for DS1, DS3, STS-1 and OCn comprise a fixed monthly fixed charge and a monthly per mile charge. For inter-office transport entrance facilities (for transport between the requesting carrier's switch location and Verizon's serving wire centre) there is a monthly fixed charge and a monthly charge per ¼ mile. Separate ordering, central office wiring, provisioning and multiplexing charges apply. The charges (except service ordering) are higher for higher capacity services.

3.5.4 Canada

Canada's regulatory framework for providing access to wholesale services is detailed under Telecom Decision CRTC 2008-17 which assigns services to six service categories in relation to their degree of need by other parties (the extent to which they are "essential" services) and the associated pricing principles for each. Listed below are some illustrative charging structures for some of these regulated services offered by Bell Canada under its current regulatory tariffs:

- *Low speed competitor digital network (CDN) DS-0 and DS-1 access* – Bell Canada's CDN monthly access rates differ by capacity and exchange bands. Service order charges apply which rise with capacity. (Bell Canada 2009).
- *Low speed CDN transport between ILEC central offices (DS-0 and DS-1); fibre-based access and transport services including CDN DS-3, OC-3, OC-12 and Ethernet access; intra-exchange and metro interexchange transport; and CO channelization and Ethernet transport* – Bell Canada's CDN metropolitan inter-exchange channel service comprises a monthly charge per mile that varies by capacity. A service order charge also applies. For Ethernet Network Paths monthly rates apply which vary by capacity and for Metropolitan, Provincial and Regional locations (Bell Canada 2009).

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29 The rules are contained in the FCC *Triennial Review Order* August 2003 and its *Order on Remand In the Matter of Unbundled Access to Network Elements*, February 2005.

3.5.5 New Zealand

The transmission services regulated in New Zealand are the Unbundled copper local loop (UCLL) backhaul service and the Enhanced unbundled bitstream access (UBA) backhaul service. Both are regulated under Standard Terms Determinations (STDs). For UCLL backhaul regulation applies only to those routes where Telecom faces "limited competition". Prices have been determined from international benchmarking. For the monthly charges this involves the use of a regression equation, derived from the international pricing data, to estimate prices using distance and capacity as explanatory variables (Commerce Commission 2008a and 2008b).

All countries within the benchmarking sample had prices that varied by distance (although in same cases in very broad steps, such as metro/regional), and most had prices that increased non-linearly with capacity.

These relationship are further discussed in **Box 1** below.

Box 1: New Zealand regressions for distance / capacity

The regression equation estimated by the Commerce Commission is as follows:

$$\ln(\text{Price}) = 4.63 + 0.3858 \ln(\text{mbps}) + 0.5071 \ln(\text{km})$$

- where ln is the natural logarithm.

Both distance and capacity variables in the regression are significant at the 99% level, and the Adjusted R^2 is 0.44.

Given that the benchmarks are (said to be) taken from countries which apply FL-LRIC methods, we can interpret this also in terms of cost changes. This specification – chosen for its better fit than a linear model – is consistent with a positive relationship between costs and capacity, and costs and distance, but which increases at a diminishing rate. The Adjusted R^2 indicates that there is still a significant amount of unexplained variation in the data – which could be due to either country-specific cost factors or another omitted factor/s.

As the variables are in logarithms, we can interpret the coefficients as elasticities, so that:

- A 1% increase in capacity increases prices by 0.39%; and
- A 1% increase in route distance increases prices by 0.51%.

This evidence therefore supports the view that while both factors are important, the route length drives costs relatively more than does capacity (in the long run).

The Commission also tested whether connection charges varied with capacity. There was no support for this in the data (i.e. a capacity variable was found to be insignificant).

TheNZ charges comprise a connection charge per end, and monthly rental rates that vary by distance (or distance ranges for shorter distances) and by capacity of service.

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3.6 OTHER PRICING OBJECTIVES?

Aside from the question of what price structures for transmission services will best promote economic efficiency, a further consideration is to what degree the pricing structure promotes competition.

The prices that would best promote competition are those based on the short run marginal costs of the access provider. This is on the basis that these prices will be the access price imputed by the access provider's retail operation. Only these prices can meet the objective of "competitive neutrality" [30]. However, in light of the discussion in Section 3.2, this objective is probably best achieved by pricing that reflects long-run costs and adhering to policies that require the access provider to demonstrate some degree of equivalence in the pricing of access services.

3.7 CONCLUSIONS AND APPLICATION

The theoretical material and available information on the cost drivers of transmission suggests that that wholesale transmission prices should include a number of key features. These are:

- prices should recover marginal, fixed and common costs;
- to reflect the cost drivers of transmission services and to promote the efficient recovery of common costs, transmission prices should consist of:
  - connection charges to recover the once-off costs of circuit connection;

30 J. Gans and S. King, *When are Regulated Access Prices Competitively Neutral? The Case of Telecommunications in Australia*, Mimeo, 2004.

- an ongoing distance-related charge to recover the costs of civil works, fibre cables and accommodation; and
- an ongoing capacity related component to recover the costs of optical equipment.

This structure of prices is also supported by commercially observed charge structures both in Australia and by regulated transmission charge structures in a number of comparable international jurisdictions.

3.7.1 Conversion of costs into prices

In order to consider how this charging structure would work in practice, we provide the following simplified example (see Figure 4). This is designed to illustrate in particular, how the distance charge can serve as a means of allocating the cost of civil works that are common to a number of routes or services. This approach, by allocating less of this common cost to shorter routes and more to longer routes, helps to avoid inefficient (i.e. higher cost) by-pass by alternative infrastructure providers.

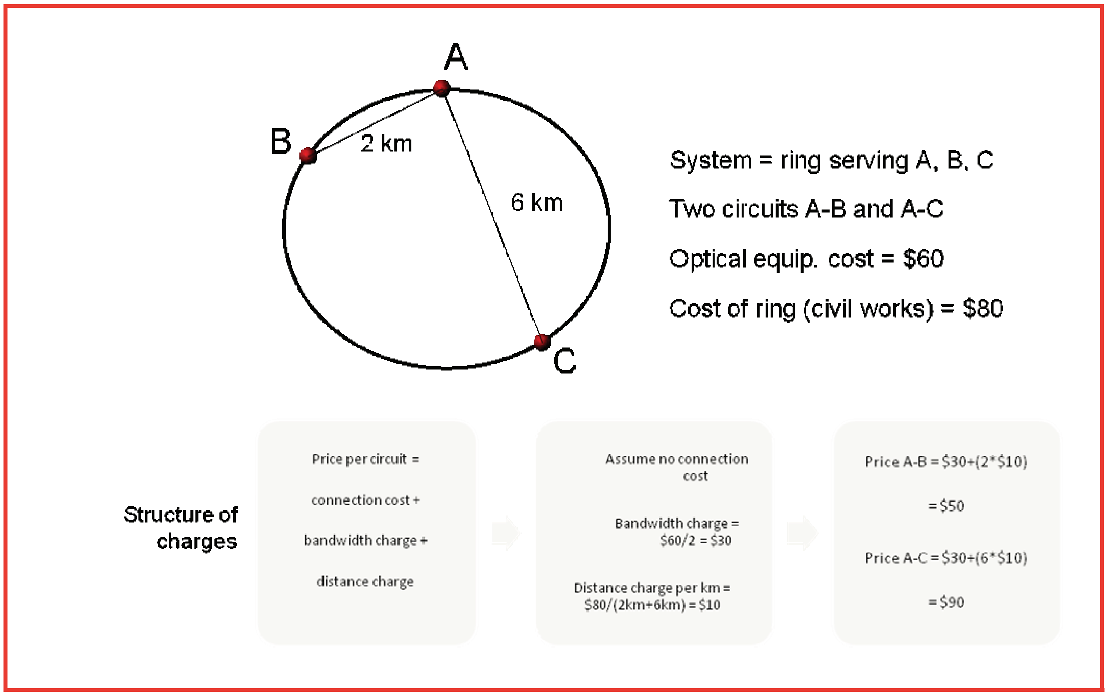

Figure 4: Applying the charging structure

In reference to Figure 4, the transmission network or system is represented by a ring connecting exchanges A, B and C. It is assumed that there are only two transmission services (circuits) of the same capacity that are provided by the system. These are transmission between A and B and transmission between A and C. It is further assumed that transmission can go in either direction on the ring (and that the ring structure provides for a redundant path) to emphasise the ring's common cost characteristics. The radial distances between the exchanges are represented by the straight lines and the associated km distances. The cost of optical equipment in the three exchanges is assumed to be $60 and the cost of the ring itself is $80.

The boxes show the calculation of the prices from the costs and quantity information. The capacity charge of $30 per circuit is derived by dividing the optical equipment cost by number of circuits that use this equipment. The distance charge per km is derived by dividing the ring costs by the total radial distance of the two circuit connections. The resulting price of service A-B and service A-C is obtained by adding the capacity charge to the per km distance charge times the radial distance of the service. The prices for the two services of $50 and $90 recover the total costs of the ring and optical equipment of $140. Although costs recovery could have alternatively been obtained by diving the $140 equally between the two services and pricing at $70 each, this is more likely to encourage inefficient behaviour by access seekers. That is, they would be more likely to engage in inefficient infrastructure by-pass of route A-B.

In Figure 9 in Annexe B, we provide a more detailed stylised example to illustrate how more detailed cost and volume information for transmission services could be used to derive prices that reflect the pricing structure that we have outlined above.

4 Options for regulating the price of access to transmission services

In Section 3 of this report, we discussed the price structures likely to best promote efficiency and competition in the supply of transmission capacity services. In this Section we identify the standard regulatory approaches used for the pricing of access to bottleneck services, discuss when they might be appropriate to use, and whether they present problems that are likely to be relevant to transmission services. We also outline how prices for wholesale transmission-capacity-like services are regulated in other jurisdictions. In Section 5, we turn to how we might apply these pricing methods in Australia.

4.1 SUGGESTED CRITERIA FOR ASSESSING PRICING METHODS FOR TRANSMISSION CAPACITY SERVICES

The setting of 'optimal' prices for access is invariably complicated by constraints that regulators face. Some of these constraints are legal in nature and are not considered as they are beyond the scope of this report. Nonetheless, other constraints do exist, particularly to do with the incentives of the regulated firm, the information that is available and/or can be revealed, and computational complexity.

In order to assess different pricing methods, we believe it is useful to contemplate some criteria by which we can assess various methods. For example, the extent to which the pricing method:

- minimises allocative efficiency distortions from price being greater than marginal cost;
- induces the firm to invest where efficient, and otherwise behave efficiently;
- maximises transparency and simplicity (and therefore minimises regulatory and compliance costs); and
- limits the possibility of anti-competitive pricing conduct.

In the following Sections, we review the common regulatory pricing methods that could be applied to transmission capacity services. We classify these broadly as 'cost based' and 'other' methods.

Cost based	Other
• Long run incremental cost • Price floors and ceilings • Utility or building-block • Fully allocated cost • Price caps	• Light-handed regulation • Efficient component pricing rule (ECPR)/ retail minus approaches • Benchmarking

Figure 5: Methods for costing and pricing

4.2 COST-BASED METHODS

4.2.1 LRIC

The approach of allowing the firm to recover its LRIC[31] of supplying relevant services has proven to be the most popular approach with regulators and is of course well known to the ACCC.

The efficiency properties of a TSLRIC approach (i.e. treating the service as the increment) have been outlined by the ACCC and cited with approval by the Australian Competition Tribunal. We cite the passage from the C7 case at length, as it covers both the standard implementation principles of TSRLIC and also its main advantages as a costing technique.

> In considering these principles, we are in general agreement with the approach established by the Commission in its guide to Access Pricing Principles - Telecommunications (as published in July 1997). In our view, key principles include:
>
> * The price of a service should not exceed the minimum costs that an efficient firm will incur in the long-run in providing the service.
>
> * The costs are the forward-looking costs, including a normal return on efficient investment (which takes into account the risk involved).
>
> * Forward-looking means prospective costs using best-in-use technology. The access provider should only be compensated for the costs it would incur if it were using this technology, not what it actually incurs, for example in using out-of-date technology which is more costly. Of course, a firm may be using older technology because it was the best available at the time the investment was made and replacing it cannot be justified commercially. In a competitive market, however, that firm would only be able to charge on the basis of using the most up-to-date

31 or LRAIC, representing long run average incremental cost which is the per unit expression.

> technology because, if it did not (in this hypothetical competitive market) access seekers would simply take the service from an alternative service provider.
>
> * The cost of providing the service should be the cost that would be avoided in the long-run by not having to provide it. Thus, it is the additional or incremental costs necessarily incurred, assuming other production activities remain unchanged. In this matter, it assumes that Telstra and Foxtel would be providing subscription television services to subscribers.
>
> 136. This version of cost-based pricing is known as `total service long run incremental cost' ("TSLRIC"). It includes operating and maintenance costs, a normal commercial return (moderated by the risk involved) and a contribution to common costs. In our view, in the general case where access prices need to be regulated, unless pricing is on a TSLRIC basis, efficient investment is unlikely to be encouraged. This, in turn, would fail to promote competition in the long-term, as end-users would not be able to benefit from new investment (thereby also missing out on more efficient and diverse product offerings). It is always the case that once an investment is made and sunk (it cannot be undone and the money recovered by selling the infrastructure as `parts' or scrap), it is unnecessary - strictly speaking - to charge anything more than marginal cost to ensure the investor stays in business. After all, the investor is better off receiving its marginal costs rather than closing down. Such an approach, however, disregards the signals sent to other prospective investors who, if observing enforced marginal-cost pricing, are less likely to invest in the future.[32]

The particular references to TSLRIC made by the Tribunal reflect its particular application in the circumstances. That is, in order to estimate TSLRIC, a number of decisions must be made.

- how the 'total service' increment is measured;
- whether costs should be measured as forward or backward looking;
- whether costs should be measured 'bottom up' or 'top down'; and
- whether and how account should be taken of common costs.

The particular version that the Tribunal cites uses 'subscription television service' as an increment, costed on a forward looking basis.

The definition of increments is a key issue in TSLRIC modelling. In principle, the definition should be reasonably straightforward, i.e. the 'additional or incremental costs necessarily incurred, assuming other production activities remain unchanged'. However, TSLRIC is generally not applied in such a literal manner because it can result in very low incremental costs and high levels of common cost which must then be allocated with the attendant problems that this causes.[33]

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32 *Re Seven Network Limited* (No 4) [2004] ACompT 11, available at: http://www.austlii.edu.au/au/cases/cth/ACompT/2004/11.html

33 It is interesting to note that call termination charges have been the subject of recent debate in the US and the EU because the 'usual' TSLRIC approach of using broad increments has led to some undesirable consequences. There is a now a push by the FCC and European Commission to align the application of TSLRIC more closely with the economic definition, i.e. as the difference between the total cost of a multiproduct firm of supplying all services and its total cost of supplying all services except the service in question. This might even be applied to exclude the costs of internal supply, i.e. only charging for the additional capacity required by access seekers. See for example,

For example, adding a PSTN origination service to an existing set of fixed services (including PSTN termination) would actually result in very little additional cost to an access provider – as at least 50% of the total cost of the network is in civil works (e.g. trenches), which would have to be dug to provide the existing set of fixed services. In practice, the TSLRIC of services is generally determined by modelling a broader increment (e.g. call conveyance) constituting the "total service" aspect of TSLRIC, and then determining usage factors to split these costs among services.

In Australia, TSLRIC is generally applied using a 'forward looking' approach, using modern equivalent asset values and forecasting changes in asset prices over time using a 'bottom up' model. Yet this need not be the case. TSLRIC can also be derived in a 'top down' fashion using historical accounting values for assets[34], and making optimisation and efficiency adjustments if thought necessary.

Applications of TSLRIC also usually allow the access provider to add a mark-up to prices to allow recovery of common costs (to give TSLRIC+). Given that inter-service common costs are already allocated to particular services within the modelled increment, it is apparent that TSLRIC+ is in practice far closer to an average cost concept than a pure incremental cost concept (at least for the fixed network where common and fixed costs are large).

Notwithstanding the Tribunal's endorsement of TSLRIC, there are a number of criticisms that can and have been levelled at the TSLRIC approach, including:[35]

- that it exposes the regulated firm and consumers to price changes that are not driven by changes to the regulated firm's actual costs (meaning that the approach can lead to over- or under-recovery of actual investment); and
- that, under a bottom up approach, its implementation requires an unduly large number of subjective judgements about network design, patterns of demand and pricing paths – and usually over long time horizons.

Annex 8 in Ofcom's *Preliminary Consultation on Mobile Voice Call Termination,* January 2009, available at: http://www.ofcom.org.uk/consult/condocs/mobilecallterm/annex8_2.pdf.

34 Although commonly TSLRIC has been treated as a forward-looking methodology, some authors argue that TSLRIC estimates need not be based on forward-looking technology but could be based on actual or historic costs. See e.g. J. Gans and S. King, *Comparing TSLRIC and TELRIC*, July 2003. Against this, Kahn, *op.cit*, states that marginal costs "look to the future, not to the past" (p. 88). Our experience is that top-down models are normally based on a forward-looking set of asset valuations.

35 Some well known critiques include those of:

- R. Pindyck, *Mandatory Unbundling and Irreversible Investment in Telecom Networks*, NBER Working Paper, w10287, 2004.
- J. Hausman, "The Effect of Sunk Costs in Telecommunication Regulation," in J. Alleman and E. Noam, eds, *The New Investment Theory of Real Options and its Implications for Telecommunications Economics*, 1999.
- Laffont and Tirole, *op.cit*, 2000.
- H. Ergas, *Telecommunications Access Pricing: The Australian Experience*, unpublished paper, 24 January 2008.

The first issue primarily relates to the shorter regulatory time horizon than the investment horizon. This exposes the regulated firm to the prospect of changes over time in modelling approach or to changes in model inputs (e.g. network optimisation rules and modern equivalent asset valuation). These changes may prove beneficial or detrimental to the regulated firm, but, in general, it is not clear that it is more efficient for the regulated firm and consumers to be exposed to these risks.[36] This problem is accentuated by the nature of the Australian regime, which allows for price setting to occur only at times when arbitration determinations are issued or the price terms of an undertaking are accepted.

The second criticism is one that seems particularly pertinent to transmission services. Transmission assets are long lived, and the path of future demand – while expected to grow rapidly – is highly uncertain. This difficulty is accentuated by potential competition in certain geographic areas, meaning that the firm may have difficulty recovering depreciation costs if these are backloaded. While certain approaches (such as tilted annuities) are designed to deal with this problem, the fact remains that it is very difficult to determine appropriate paths for cost recovery of capital expenditures – particularly if the TSLRIC model is regularly re-set to determine new prices.

It is not possible here to go into the detail of these generic arguments and the potential counterpoints, or to discuss whether these are problems inherent to TSLRIC or merely criticisms of the way it has been applied. It is sufficient to note that the ACCC is well aware of the situations in which the criticisms have more force. For example, the ACCC has noted:

> (a) If the rolling out of fibre closer to the customer makes the prospects of efficient duplication more remote, then some of the key rationales for a TSLRIC+ approach to pricing will be less relevant…
>
> (c) The ACCC is also aware of the limitations in the application of TSLRIC+ outside its original focus for public switched telephone network (PSTN) assets, in that the TSLRIC+ concept revalues the network assets in each regulatory period such that it does not take account of [previous] depreciation in the value of the assets.[37] This limitation is particularly apparent in the case of enduring assets such as trenches which are likely to be less susceptible to bypass.[38]

4.2.2 Price floors and ceilings

In Section 3, we noted that applying Ramsey principles to the recovery of common costs (i.e. by allocating more common costs to those services with less-elastic demands) was likely to produce superior static allocative efficiency outcomes. However, it also raises that the possibility that the firm could over-

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36 This appears particularly relevant where (a) changes to asset values are driven not by technological progress but by general increases in cost of civil works and (b) there is little actual probability of those costs being incurred again.

37 We note that, strictly speaking, this criticism could be avoided if economic or other depreciation profiles were used rather than tilted annuities.

38 ACCC, *Assessment of Telstra's Unconditioned Local Loop Service Band 2 monthly charge undertaking*, Draft Decision, Public Version, November 2008

recover its costs (if all relevant services are not price-controlled) or act in an anti-competitive manner, by pricing competitive services at marginal cost and recovering common costs from non-competitive services. A regulatory mechanism that has been suggested is to use a price floor and ceiling approach – setting reasonable 'bands' for prices. Although not formally part of its *ex ante* regulatory obligations, a type of floor and ceiling approach formed the basis for Ofcom to test whether BT has met its obligations to price PPC services at FL-LRIC.[39] These methods are also extensively used in regulation of access to rail infrastructure in Australia.

The pricing bands are based on stand-alone costs of producing a service as the ceiling and LRIC as the floor.[40] These prices are said to be consistent with competitive or contestable market outcomes and to be subsidy-free.[41] In addition, where multiple services exist, it is also necessary to take into account the pricing of combinations of services to ensure that they individually meet these tests. This is so that the system meets an overall 'adding up' constraint that the prices of all the services together is equal to the stand alone cost. This may be explained in the following diagram, where we assume the firm produces three kinds of services.

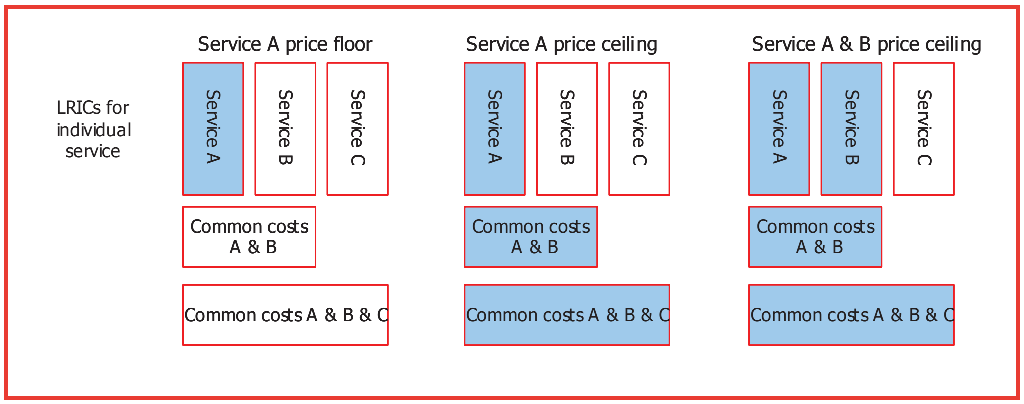

Figure 6: Application of price floors and ceilings

Source: Frontier

Price floors and ceilings are determined as follows:

- the price floor of service A is illustrated in the first diagram;
- the price ceiling of service A is illustrated in the second diagram (LRIC A plus all common costs of A & B, and A & B & C;
- the price ceiling for services A & B is illustrated in the third diagram (LRIC A + LRIC B + common costs of A & B, A & B & C).

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39 This is described in further detail in Ofcom, *Draft Determination to resolve disputes between each of Cable & Wireless, THUS, Global Crossing, Verizon, Virgin Media and COLT and BT regarding BT's charges for partial private circuits*, 27 April 2009.

40 W. Baumol & G. Sidak, *Toward Competition in Local Telephony*, MIT Press, 1994.

41 *ibid.*, Chapter 3.

It is apparent from this simple example that there are a number of pricing calculations ('combinatorial tests') that must be made to determine whether all ceilings are being met.[42] Because the nature of combinatorial testing quickly becomes onerous, in applying the approach to BT, Ofcom makes some further adjustments to the LRIC service estimates. In particular, it applies an equi-proportionate mark-up approach (EPMU) to 'intra-group' common costs (in the example above, the common costs of A & B). So the distributed LRIC (or DLRIC, as referred to by Ofcom) is above the true LRIC, and the sum of DLRICs within a group is equal to the LRIC of the group of services taken as a single increment. A similar approach is adopted to generate an amended stand-alone cost measure (DSAC). In the example, to determine the DSAC of service A, one would allocate all common costs for A & B & C to the individual services A & B within the group. So while DLRIC is above true LRIC, DSAC is below SAC. This approach significantly reduces the complexity of the floor and ceiling approach.[43]

While this approach potentially allows for superior efficiency outcomes, the determination of stand alone and incremental costs would still be required with the attendant difficulties as described under the TSLRIC methodology above. (Ofcom does not face this problem as BT's regulatory accounts already record the data necessary to determine LRIC and SAC). Vogelsang claims that for this reason the use of such bands is more common for anti-trust purposes than ongoing regulation.[44] A larger problem may be that it seems that such regulation must invariably involve the estimation of costs for both competitive and non-competitive services.

Nonetheless, the Ofcom approach demonstrates that such regulation is possible to implement for transmission-type services (PPCs), even if further practical constraints must apply that somewhat diminish its efficiency properties.

4.2.3 Fully allocated costs

A fully allocated costing approach serves to allocate costs in a company's accounts to particular service categories. The costs include costs that can be directly identified or assigned to the services in question as well as costs that are shared with other services that require allocation between services.[45] The allocations require the use of sharing factors that tend to be based on supply or demand usage factors (e.g. number of cables in a shared trench, or Mbps capacity of services demanded per transmission link).

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42 *ibid.,* p. 71.

43 Ofcom, *op.cit.*, see Annex 13.

44 I. Vogelsang, "Optimal price regulation for natural and legal monopolies", Paper prepared for CIDE seminar on structural reform and regulation in the energy sector, 1998, p. 12.

45 M. Jamison, "Regulatory techniques for addressing interconnection, access and cross-subsidy in telecommunications" in Arblaster, M. & Jamison, M. (eds) *Infrastructure Regulation and market reform: Principles and practice*, 1998, p. 118.

One shortcoming of the use of FAC is that it tends to be backward looking, reflecting what expenditures that a company has undertaken in the past. Such costs may bear little relation to the decisions of the firm looking forward. It is for this reason that adjustments to historical cost accounts may be used, such as current cost accounting (CCA) or other adjustments to better proxy FL-LRIC (e.g. to remove common costs and redundant assets). While this may in theory bring the costs closer to those costs necessary for promoting economic efficiency, in practice the scope for discretion and arbitrariness in these exercises can limit the extent to which FAC-based prices reflect efficient price levels.

A particular difficultly in applying FAC to estimate transmission capacity service costs is that there may be insufficient account granularity, so that allocations of a pool of transmission costs from regulatory accounts to individual services (for example allocation of cost of multiplexing equipment to different speed services or to account for costs on a route or ring basis) could readily become very complex and/or arbitrary. We comment further on this in Section 5.

4.2.4 Cost of service or utility style methods

Utility methods of regulation are broadly referred to here to cover a number of different types of costing and pricing methods that facilitate cost recovery by the regulated firm. In Australia this is most closely aligned with the 'building block' model.

The defining features of the 'building block' model are:

- the establishment of a regulatory asset value for fixed assets used for regulated products and services at the beginning of each control period, with this asset value derived by taking that determined at the beginning of the last control period and updating it for additions, depreciation and disposals; and
- the establishment of company-specific, forward-looking estimates of efficient operating costs, capital expenditure, depreciation and corporation tax for the period of the control. The allowable returns may be structured as either a price cap, revenue cap or rate-of-return.

The utility approach to regulation appears useful in situations where the primary concern of the regulator is to balance the goals of efficient pricing and procuring sufficient investment. That is, the regulator is not so concerned about anti-competitive pricing or about the efficiency of existing investment (due to technical obsolescence). The utility approach therefore seems better suited to industries where there are strong natural monopoly characteristics with slow technological progress, with vertically-separated suppliers (such as electricity), and where the firm only supplies regulated products and services.. The separation facilitates use of broad price, revenue or rate-of-return caps without great concern about discrimination, as in these circumstances discrimination is likely to improve efficiency.[46]

46 Consistent with ACCC's findings on G9 proposal for FTTN.

A problem of applying the utility model to transmission capacity services is that it would be difficult to determine and update a regulatory asset value for non-competitive services. Although not unique to this approach, as most costing approaches will require some form of cost allocation if pricing regulation is not to apply to competitive routes, it seems that it would diminish one of the key advantages of this model – the predictability of the regulatory asset value.

4.2.5 Price caps (CPI-X regulation)

In practice, price caps are not an independent means of setting prices but are used as a complementary measure to cost-based regulation. Price caps can provide a means of making the provider reach efficient costs over time and/or to maintain efficient costs once these have been determined by allowing prices to increase only by the rate of inflation (either measured by the consumer price index – CPI – or retail price index – RPI) less an estimate of anticipated efficiency gains (X). It is common to apply the CPI-X cap to a basket of services, to provide the access provider with a degree of price discretion across services.

One of the key attractions of this pricing approach is that it can, depending on the degree of price flexibility allowed within the cap, be used to allow the access provider to govern the structure of prices, including deciding how to allocate common costs across services. This can therefore help to greatly reduce the regulatory effort by the regulator, the regulatory burden on the regulated firm and the prospect of information asymmetries and the possible inefficiencies that arise as a result of therm.

However, similar to other types of costing described above, an issue with applying price caps is how to allocate cost between non-competitive services (within the price cap) and competitive services (outside the price cap).

Price cap regulation of transmission services is used in the UK, the US and Canada. In the UK, Ofcom applies *both* a FL-LRIC cost obligation and a price cap for PPC terminating services. This methodology enables Ofcom to take a lighter handed approach to the determination of individual prices – by checking that prices are below DSAC[47] for each service and that the price cap is met overall. Ofcom describes this as follows:

> A13.33 Therefore, although BT was obliged to price the services within the low and high bandwidth baskets in such a way that the weighted average price complied with the control, it had flexibility over the charges for the individual services within the basket and sub-baskets.
>
> A13.34 For services within charge control baskets, however, BT's ability to set charges close to the ceiling will be constrained by the requirement for it to comply with the charge control. This is because the charge control is designed to regulate charges relative to the incremental costs of providing the services plus a proportion (but not all) of the common costs shared by the services. Therefore, setting one charge within a basket near the ceiling will mean that other charges in

[47] see Section 4.2.2 for an explanation of DSAC.

> the basket will need to be set nearer the floor to meet the requirements of the control.
>
> A13.35 Cost orientation obligations were therefore imposed in conjunction with basket-level charge controls to provide a complementary (but independent) constraint on BT's ability to flex individual prices in order to recover common costs in a way that could be considered inappropriate or, indeed, anti-competitive.[48]

The US provides an example where there is flexible application of the cap with regard to the extent of competition in the market, as discussed in Section 4.4.2.

4.3 NON-COST BASED METHODS

4.3.1 Lighter handed regulation – price transparency and reliance on competition law (no price squeeze rule)

Lighter-handed approaches to the regulation of access prices might take a number of forms:

- a requirement that prices be "just, reasonable and non-discriminatory", as applies in some cases in the US;
- a requirement to publish tariffs or provide reference offers;
- a 'safeguard' price control that seeks to limit prices increases over time; or
- a requirement that the access provider demonstrate that its access and retail prices avoid creating a price squeeze in downstream markets according to a set methodology.

These approaches might be more suitable where there is a reasonable degree of confidence about competition, but not sufficient to leave the service or market completely unregulated. An example might be where the number of access seekers is sufficient to exercise countervailing power (say through their buying power or control of access markets in related markets to which the access provider in question requires access).

The advantages of these approaches are that they can:

- limit the costs of regulation and preserve incentives to invest, which may be particularly important in situations where there has already been some competitive entry;
- provide some confidence to downstream parties that there is competitive neutrality between themselves and the access provider; and
- provide some evidence to ensure that the access provider does not engage in price squeezes.

While transparency measures and regulations to prevent price squeezes would address to a degree the problem of discrimination between internal and external

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48 Ofcom, *op.cit.* p. 147.

supply of transmission capacity services, it would not address the core problem of high prices. Further, the difficult cost allocation questions that we have described in this paper would be likely to arise again in determining a methodology to avoid price squeezes.

4.3.2 Benchmarking

Benchmarking approaches have the advantage of being relatively quick and low cost to apply. However, as discussed below, the establishment of robust benchmarks can be difficult.

International

A difficulty for international benchmarking in respect to Australia is to be able to identify countries with similar characteristics including terrain, transmission distances and route demand, input costs (notably the cost of capital and labour) and which use a suitable cost methodology and for which such information can be readily extracted. Exchange rate levels and movements can also complicate such comparisons.

The experience in New Zealand is instructive in this respect. The Commerce Commission – which was required to set prices initially using a benchmarking approach – expressed reservations about the comparability of jurisdictions that were used in its final determination (none of the 10 comparable jurisdictions identified had suitable comparable data).[49]

Nonetheless, benchmarking can provide a useful cross-check on the reasonableness of rates in certain circumstances – for example, as used by the ACCC in assessing Telstra's ULLS undertaking and as an input into the determination of mobile termination charges.

Domestic

Within Australia there are inter-capital and some regional-capital routes that are not subject to the transmission declaration as they are judged to be competitive. This raises the possibility that the commercial pricing on these routes could be used as benchmarks for pricing on non-competitive routes. There are likely to be a number of issues with this that may limit such an undertaking. These are:

- matching route lengths – as distance is a key driver of costs, it might be necessary to compare routes with similar distance if these costs are subject to economies of scale;[50] and
- matching route usage – usage affects the average costs of a route, so that routes with higher usage will tend to have lower unit costs and prices.

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49 Commerce Commission, *Standard Terms Determination* (Decision 626), p. 56, June 2008.

50 If there are not large economies of scale (i.e. declining unit costs with respect to distance) benchmarks can be set on a per km basis. With the presence of economies of scale, a per km benchmark can also be established following estimation of a functional relationship, such as has been done under the New Zealand benchmarking exercise detailed in Section 3.

Although these problems can make benchmarking price levels problematic, benchmarking can fulfil two useful functions:

- to apply the changes in prices on competitive routes to prices on non-competitive routes once establishing a suitable base price for non-competitive routes; or
- to determine the appropriate price structure on a non-competitive route.

4.3.3 ECPR and related approaches

The use of the ECPR to set access prices has a controversial history. It has not been widely applied by regulators of network industries. However, when used in certain contexts, the logic of the ECPR is compelling.

The mechanics of the ECPR are reasonably simple. The ECPR access price consists of three components – the incremental costs of supplying access, the revenue lost from not supplying the service in the downstream market, and costs saved from not supplying the service in the downstream market. The revenue lost, or 'opportunity cost', is essentially revenue forgone as a result of a competitor entering and capturing some share of the downstream market.

The compelling nature of the ECPR stems from its encouragement of efficient competition in the market for the downstream service (in which the vertically-integrated firm and the access seeker compete). The ECPR is a direct test of the potential entrant's efficiency. As Kahn and Taylor note:[51]

> *When a would-be entrant proposes to offer its services in competition with an existing supplier it is the task of efficient competition to ensure that the aspiring competitor prevails to the extent – and only the extent – that the total incremental costs to society involved in its supplying the service are equal to or lower than those of the incumbent.*

Perhaps a simpler way to think of the ECPR is that it sets access prices by focusing only on activities in the downstream (competitive) market, not the upstream (monopoly) market. In doing so, it preserves any profits (or losses) that derive from the upstream market. This preservation of contributions to profit can be important in industries where there are high levels of fixed and sunk costs, as if these profits are lost, they may need to be recovered elsewhere for the firm to be viable.[52] Equally, it may also be useful to take into account the preservation of losses. Suppose, for example, that retail prices to certain customers are below the end-to-end costs of serving those customers by $x, which is a subsidy to those customers. Then ECPR access prices will be below the incremental costs of providing access by $x. That price will promote efficient entry in the downstream market, in the sense that it will minimise the total costs of producing the downstream services, even if end-to-end prices do not recover costs. With that in mind, it is clear why the ECPR has proven to be controversial. In network industries, one of the explicit goals of access regulation has been to increase

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51 A. Kahn & W. Taylor, "The Pricing of Inputs Sold to Competitors: A Comment", *Yale Journal on Regulation*, Vol 11: 1994, p 237

52 that is, assuming that the profits are not monopoly profits.

allocative efficiency by reducing the monopoly profits embedded in retail prices. While the ECPR achieves one dimension of efficiency (the efficiency of production in the downstream market), that can occur at the expense of other dimensions of efficiency, as final prices are unaffected by the costs incurred by the Access Provider in offering the access service.

The proponents of the ECPR[53] do not deny that it has a narrow focus. Rather, they argue that any access price cannot be used to simultaneously achieve goals of efficient entry and allocative efficiency. Proponents accept that other complementary measures may need to be taken to prevent abuse of monopoly power (e.g. retail price controls).

The primary usefulness of the ECPR occurs when one is not so concerned about the price level but rather ensuring efficient entry – perhaps because the retail price structure embodies cross-subsidies. In these circumstances, the ECPR can be a useful regulatory pricing tool. This appears to be an important consideration in industries like water, with a 2000 NERA report arguing that:

> "We conclude that in the current circumstances of the UK water industry ECPR is more appropriate as a basis for setting access charges than an approach where prices are centred on Long Run Marginal Cost (LRMC). This is because in our view in the early stages of competition ECPR is more likely to lead to access prices that reflect the need to cover total costs, is more likely to avoid inefficient entry, and is more likely to allow companies to meet existing customer service obligations and to limit the possibility of "cream skimming" that would put pressure on companies to unwind existing regionally averaged retail tariff structures".[54]

However, these circumstances appear less relevant to the pricing of transmission capacity services.

A further major shortcoming of ECPR for the pricing of transmission services is that in many cases (say in the case of exchange to exchange transmission) the transmission component of the retail service will only be a small component of the overall costs of the retail service. Hence to arrive at a wholesale transmission price it will be necessary to subtract not only retail costs but also the costs of other components that make up the price of the retail service. Indeed, where it has been applied by regulators it has been for the purposes of setting wholesale resale prices (e.g. ACCC pricing of the wholesale Local Call Service (LCS) and the setting of wholesale resale rates in the US).

A further extension of the ECPR concept was the global price cap of Laffont and Tirole (1996). The global price cap includes both access prices and final goods prices, and implements the optimal Ramsey price structure (i.e. it is able to correct the major deficiency of the ECPR). However, the theoretical elegance of

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53 The ECPR is also known as the Baumol-Willig pricing rule after its main proponents. For a discussion of the ECPR and its application for pricing access to Telecom's local loop in New Zealand see W. Baumol and G. Sidak , "The Pricing of Inputs to Competitors", *The Yale Journal of Regulation* Vol 11, 1994.

54 NERA, *Access Pricing in the UK Water Industry: The Efficient Component Pricing Rule – Economics and the Law,* a report for Northumbrian Water, March 2001, London.

the global price cap has not resulted in its implementation in any jurisdiction of which we are aware. As well as requiring significant amounts of data, it has also been subject to criticism because it subjects potential competitive activities to regulation (with all its attendant costs and limitations).

4.4 INTERNATIONAL APPROACHES TO REGULATION

Our review of the methods used to regulate transmission prices in other countries has revealed that forward looking LRIC is widely applied, particularly with respect to those transmission segments deemed least competitive. In the case of Canada and for some services in the UK, this is accompanied by RPI-X price cap regulation. In New Zealand benchmarking is used but this is based on prices in those countries that apply such costing methodologies. In the US, there is an explicit gradation of pricing requirements that relates to increasing levels of competition, beginning with cost-based requirements, secondly non-cost-based price capping; and thirdly simple requirements to offer services (on just, reasonable and non-discriminatory terms) and to post tariffs.

We have also searched for evidence that regulators or access providers had sought to use bottom-up modelling and/or route-specific costing as part of costing requirements. We have found limited evidence of bottom up modelling and no evidence of route-specific costing.

We summarise this evidence in the table below, and some specific details of the methods of regulation in different countries are then outlined. In Annexe A, we provides a consolidated table outlining of the services regulated, the type of wholesale regulation applied and the structure of wholesale prices.

Country	Services	Costed increment	FL-LRIC?	Bottom up?	Other comments
UK	Terminating segments	BT required to cost each and every speed of service, UK wide	✓	✗	RPI-X cap also applies
	Trunk segments	BT required to cost each and every speed of service, UK wide	✓	✗	BT allowed to set geographically de-averaged prices Trunk segments proposed to be included in new charge controls
Ireland	Terminating segments	Whole service, Ireland-wide	✓	✗	Will hold consultation as to how to best apply obligations
	Trunk segments	Unregulated as considered prospectively competitive			
US	~Terminating segments and inter-exchange services	Whole service, state by state variation	Varies by type of service	✓	Gradations in regulation apply depending on competition
Canada	~Terminating segments and inter-exchange services	Whole service, company service area	✓	Unclear but likely	CPI-X caps also apply
France	Terminating segments < 10mbps	Services < 10mbps, France-wide	Unclear but likely	Unclear but likely	
	Inter-urban segments	Not subject to cost orientation			Requirement to not price 'excessively'
New Zealand	~Inter-exchange plus capital-regional	NZ wide	Benchmarking – so depends on comparator countries – but is supposed to reflect FL-LRIC		

Table 7 Summary of international regulatory approaches

4.4.1 European Union

Under the EU regulatory framework, Member States are required to conduct market definition and analysis of each of the telecommunications and broadcasting markets nominated by the Commission as likely to require *ex-ante* regulation. If an operator or several operators are found to have significant market power (SMP) then the national regulatory authority (NRA) may implement *ex ante* regulation. The regulatory framework identifies a range of regulatory obligations which NRAs can define and implement: [55]

- transparency;
- non-discrimination;
- accounting separation;
- access; and
- price control including cost orientation.

Wholesale trunk segments of leased lines were identified as a relevant market in the 2003 European regulatory framework, that is, the market is one of the 18 telecommunication and broadcasting markets that were likely to require *ex ante* regulation. However they were removed from an updated list of markets published in 2007. This leaves only wholesale terminating segments of leased lines and wholesale broadband (bitstream) access as transmission-like services falling under the EC rules.[56]

Competitive conditions and the structure of tariffs for transmission services vary between countries, and while NRAs have some flexibility in the way in which they design regulatory obligations, NRAs are required to notify the European Commission (EC) of any market analysis and regulatory decisions. They are also required to take the utmost consideration of any EC recommendations. There is therefore some scope for variation in the way in which wholesale transmission services are regulated.

The European Regulators Group (ERG) published a common position on the best practice regulation of wholesale leased lines in 2007.[57] This provides guidance on the regulatory objectives and competition issues that may arise but does not provide any guidance on the structure of tariffs and charging principles. Moreover, the guidelines do not address the issue of costing transmission services or the relative merits of route by route pricing. It is therefore helpful to look at regulatory decisions made by NRAs in individual Member States, which is done below for the United Kingdom, France and Ireland.

United Kingdom

The regulation of 'business connectivity' services (including terminating and trunk segments of leased lines) is currently under review in the UK.[58] Ofcom has

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55 Directive 2002/19/EC of the European Parliament and of the Council of 7 March 2002 on access to, and interconnection of, electronic communications networks and associated facilities (Access Directive)

56 See EC, *2007 EU Telecoms Reforms,* Factsheet No. 9.

57 ERG, *ERG common position on best practice in remedies imposed as a consequence of a position of significant market power in the relevant markets for wholesale leased lines*, ERG (07) 54 final 080331

58 Ofcom, *Business Connectivity Market Review*, December 2008, available at: http://www.ofcom.org.uk/consult/condocs/bcmr08/summary/

yet to publish a final regulatory decision, which was expected to be published in March 2009 and to take effect in April 2009.

As the incumbent operator in the UK, BT is required to produce independently audited regulatory financial statements each year which include cost and revenue reporting for wholesale transmission services. These regulatory accounts are used in combination with other data sources to ensure that BT is in compliance with its regulatory obligations. The following wholesale transmission markets are subject to regulatory obligations in the UK: [59]

- low bandwidth traditional interface symmetric broadband origination (TISBO below 8Mbps);
- high bandwidth TISBO (between 8Mbps and 155MBps);
- wholesale trunk segments at all bandwidths; and
- alternative interface symmetric broadband origination (AISBO) at all bandwidths.

BT is subject to the following regulatory obligations for each of these services:

- requirement to provide network access upon reasonable request;
- no undue discrimination between BT downstream operations and other alternative operators;
- cost orientation (prices "reasonably derived from the costs of provision based on a forward looking long run incremental cost [FL-LRIC] approach and allowing an appropriate mark up for the recovery of common costs including an appropriate return on capital employed");
- requirement to publish a reference offer;
- requirement to notify charges and terms and conditions;
- maintenance of quality of service;
- requirement to notify technical information; and
- requirement to publish reasonable guidelines relating to new network access.

In addition to the regulatory obligations listed above, high and low bandwidth TISBO services are also subject to an RPI-X% charge control.

BT is subject to regulation of wholesale trunk segments in all geographic areas and routes in the UK, although in the 2004 market review BT was allowed to set geographically de-averaged prices for trunk segments.[60] BT is subject to regulation of the other services listed above in all geographic areas and routes in the UK except for the Hull area where Kingston Communications (KCOM) has significant market power (SMP) and is subject to the same regulatory obligations that BT is subject to in the rest of the UK.

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59 Ofcom, *Review of the retail leased lines, symmetric broadband origination and whole trunk segments market*, Final statement and notification, published 24 June 2004.

60 *ibid.,* see chapter 8, p. 192.

While radio basestation (RBS) backhaul link services are not included within the charge control, BT is required to price these services in a manner that is consistent with TISBO pricing since these products are considered by Ofcom to be technically equivalent. Both RBS backhaul and local loop unbundling (LLU) backhaul trunk segments are included within the wholesale trunk segment definition.

The FL-LRIC estimates for PPC and other services are calculated using BT's regulatory accounts on a top-down basis.[61] The pricing of PPC services is actually the subject of an ongoing dispute between BT and other providers. A draft determination was published by Ofcom on 27 April 2009 that concluded that BT was not meeting its cost orientation obligation. For the purposes of the dispute Ofcom assessed compliance by making adjustments to the regulatory accounts and comparing revenues against the DSAC (distributed stand alone costs). DSAC and revenues for aggregated services are published by BT in regulatory accounts. DSAC was assessed to be the maximum that BT could charge for each service in order to meet its costs orientation obligation.[62]

France

The French regulator, ARCEP, undertook a review of wholesale terminating segments of leased lines (Market 13 in the EU recommendation) and wholesale trunk segments of leased lines (Market 14) in 2006.[63]

ARCEP identified one terminating segment market and several inter-urban trunk markets. France Telecom was considered to hold market power on all these segments, and was made subject to the following obligations:

- Requirement to provide access
- Non-discrimination
- Transparency
- Requirement to publish quality of service indicators
- Publication of reference offer
- Tariff control -

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[61] See BT's Primary Accounting Documents, available at: http://www.btplc.com/Thegroup/RegulatoryandPublicaffairs/Financialstatements/2006/PrimaryAccountingDocuments.pdf, p. 56: "A "top down" LRIC model is used taking actual reported costs to calculate the LRICs. The cost data is obtained from the CCA AS system, which uses the Financial Capital Maintenance convention."

[62] Ofcom, 2009, *Draft Determination to resolve disputes between each of Cable & Wireless, THUS, Global Crossing, Verizon, Virgin Media and COLT and BT regarding BT's charges for partial private circuits*, 27 April.

[63] ARCEP, *Décision n° 06-0592 de l'Autorité de régulation des communications électroniques et des postes en date du 26 septembre 2006 portant sur la définition des marchés pertinents des services de capacité, la désignation d'opérateurs exerçant une influence significative sur ces marchés et les obligations imposées à ce titre*, 26 September 2006 http://circa.europa.eu/Public/irc/infso/ecctf/library?l=/france/adopted_measures/fr20060415-0416-0417/dcision_06-0592pdf/_FR_1.0_&a=d

- terminating segment less than 10 Mbit/s - cost orientation and requirement to not use predatory pricing
- terminating segment more than 10 Mbit/s (fibre optic) - no cost obligation and no requirement to not use predatory pricing[64]
- inter-urban circuits (except to Reunion) - no cost orientation obligation but requirement not to price excessively

An interesting feature here is that ARCEP only sought to apply cost orientation obligations to terminating segment services of less than 10 mbps, which were primarily delivered using France Telecom's 'copper' access network.

For Market 12 (wholesale broadband access – said to cover "bit-stream access that permits the transmission of broadband data in both directions and other wholesale access provided over other infrastructures, if and when they offer facilities equivalent to bit-stream access"), ARCEP split its analysis into two Sections[65]:

- a regional market in which France Telecom was subject to accounting separation and cost orientation obligations. ARCEP determined that prices must reflect "long run costs of an efficient operator with characteristics comparable to those of France Telecom". While not specifically requiring a LRIC approach it does seem to imply a bottom up approach.
- a national market which is no longer subject to cost orientation obligations as it was found to be sufficiently competitive.

Ireland

In Ireland, terminating segments of wholesale leased lines are subject to *ex ante* regulatory obligations whereas wholesale trunk segments are not.

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64 While for terminating segments more than 10 Mbit/s there is no ex ante requirement to not use predatory pricing, such anti-competitive behaviour would not be permitted under *ex post* national and EU competition law.

65 Further information is available (in French) on the markets as follows:

National market

http://circa.europa.eu/Public/irc/infso/ecctf/library?l=/france/adopted_measures/fr20060554/dcision_rgulation/2007-0089_rgulation/_FR_1.0_&a=d

"Decision no 2007-0089 portant sur la levee de la regulation du marche des offres de gros d'acces large bande livrees au niveau national", 30 January 2007

Regional market

http://circa.europa.eu/Public/irc/infso/ecctf/library?l=/france/adopted_measures/fr20050175/communication_dcisions/05-0280_obligations/_FR_1.0_&a=d

Decision no 05-0280 relating to the obligations imposed on France Telecom for Market 12 a the regional level, 19 May 2005 (Section II-E-1-a: tarification refletant les couts)

Accounting separation obligations

http://circa.europa.eu/Public/irc/infso/ecctf/library?l=/france/adopted_measures/fr20060520/n06-1007_obligations/06-1007_comptablepdf/_FR_1.0_&a=d

The market for wholesale trunk segments of leased lines was found to be prospectively competitive and hence not requiring *ex ante* regulation.Trunk segments are defined as segments with capacity greater or equal to STM-1 (155Mbps) connecting high densities of traffic via high capacity connections, between and within major centres of population. There are about 15 of these urban centres. Intra-urban routes (in other words, routes between exchanges in the same urban area) fall under the terminating segment market. The Commission for Communications Regulation (ComReg) concludes that routes where other authorised operator (OAO) investment has not occurred are characterised by different economic conditions of supply to trunk segments and therefore should be treated as terminating segments.

Terminating segments of wholesale leased lines provided by Eircom are subject to the following regulatory obligations:

- requirement to provide access;
- obligation of non-discrimination;
- requirement to publish a reference offer (transparency);
- accounting separation;
- non discrimination between Eircom's retail arm and OAOs;
- cost (forward looking long run incremental cost – FL-LRIC) orientation; and
- no margin squeeze.[66]

In terms of implementing FL-LRIC costing, ComReg has noted the following:

> ComReg notes that it has stated its intention to hold a consultation on how to best implement cost orientation in the market for wholesale terminating segments of leased lines, and this consultation will look at the effects of such an accounting mechanism on the PPC product. Furthermore, ComReg will shortly be consulting on the levels of PPC pricing.[67]

4.4.2 United States

In the United States, under current FCC rules incumbent carriers musts offer a range of transmission services as unbundled network elements to competitors. The type of regulation applied differs depending on the services and the level of competition or "impairment" of competitors.[68] While the framework for regulation is largely set by the FCC, the State Public Utility Commissions administer the regulations for those services that are supplied within their states.

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66 ComReg, *Market Analysis – Leased Line Market Review: Response to Consultation on draft Decision Instrument, Final Decision Notice and Decision Instrument*, Decision Number D06/08, Document Number 08/103, published 22 December 2008, available online: http://www.comreg.ie/_fileupload/publications/ComReg08103.pdf

67 *ibid.*, p. 16.

68 The rules are contained in the FCC *Triennial Review Order,* August 2003 and its *Order on Remand In the Matter of Unbundled Access to Network Elements*, February 2005.

Under the FCC rules, high speed data transmission including Ethernet, optical networking, Frame Relay and ATM must be made available by ILECs on wholesale basis to other operators on "just, reasonable and non-discriminatory rates and terms", but no specific tariff regulatory mechanisms apply (Maxwell 2007).

In relation to "Special access" services including high-capacity (DS1 and DS3) fibre loops and backhaul in TDM format, ILECS must make these available under non-discriminatory public tariffs to competing operators. Generally tariffs are subject to price cap regulation (not cost-based), whereby weighted average price for a basket of services must be no greater than the price during the previous year with adjustments for inflation and productivity (ie CPI-X regulation). However, greater flexibility is permitted depending on the number of fibre collocations, extent to which CLECs use alternative backhaul (the flexibility includes volume and term discounts, contract tariffs, and in most competitive areas, removal from price caps altogether). (Maxwell 2007).

Price regulation of wholesale DS1 and DS3 fibre loops is based on total element long run incremental costs (TELRIC), but only in those wire centres where CLECs are considered to be "impaired" without access to these facilities. Thresholds for absence of "impairment" are defined as those for which there are a certain number of fibre connections and/or level of line density. Above these thresholds access is still required but under the terms for "special access" described above (Maxwell 2007).

4.4.3 Canada

Canada's regulatory framework for providing access to wholesale services is detailed under Telecom Decision CRTC 2008-17. This Decision assigns services to six service categories relation to their degree of need by other parties (the extent to which they are "essential" services). Pricing principles are specified for each of these service categories.[69] The application of this framework to key transmission services is detailed below.

Low speed competitor digital network (CDN) DS-0 and DS-1 access are defined by the CRTC as "conditional essential" under the regulatory framework. For ILECs other than Telebec and TCC in Quebec, prices are determined according to company specific prospective incremental costs (termed Phase II costs) plus a mark-up of 15 per cent. In the case of Telebec and TCC the same pricing principle applies but the mark-up is 25 per cent. (CRTC 2008, paras 124, 134). Price cap regulation of inflation less productivity (I-X) applies for services not exempted previously. Co-location (incl. IC-to-IC cross connection), CO connecting links, dedicated access lines, aggregated ADSL and third-party internet access are defined by CRTC as "conditional mandated non-essential" under revised regulatory framework. Pricing is required on the basis of Phase II costs (defined above) plus a mark-up of 15 per cent (CRTC 2008, paras 124,

69 CRTC, *Revised regulatory framework for wholesale services and definition of essential service*, CRTC 2008-17, 3 March 2008.

137). Price cap regulation of inflation less productivity (I-X) applies for services not exempted previously.

Interconnection between LECs, between LECs and long-distance networks and between LECs and wireless service providers; transiting services for local, toll and CCS7 services; and dialled number transport capability are defined by the CRTC as "interconnection" under the regulatory framework. Pricing is required on the basis of Phase II costs (defined above) plus a mark-up of 15 per cent (CTRC 2008, paras 124, 142). Price cap regulation of inflation less productivity (I-X) does not apply if I is less than or equal to X. If I is greater than X, an ILEC may file applications "as appropriate" (CTRC 2008, paras 143-149).

Low speed CDN transport between ILEC central offices (DS-0 and DS-1); fibre-based access and transport services including CDN DS-3, OC-3, OC-12 and Ethernet access; intra-exchange and metro interexchange transport; and CO channelization and Ethernet transport are defined by the CRTC as "non-essential subject to phase out". Phase-out periods of between 3-5 years are specified. Pricing is on the basis of Phase II costs (defined above) plus a mark-up of 15 per cent. Price cap regulation of inflation less productivity (I-X) applies. Negotiated rates (competitor agreements) are permitted which do not require CRTC approval, although the CRTC reserves its right to deal with instances of unjust discrimination or undue preference (CRTC 2008, paras 162-166).

4.4.4 New Zealand

The transmission services regulated in New Zealand are the Unbundled Copper Local Loop (UCLL) backhaul service and the Enhanced Unbundled Bitstream Access (UBA) backhaul service. Both are regulated under Standard Terms Determinations (STDs). For UCLL backhaul, regulation applies only to those routes where Telecom faces "limited competition". Prices have been determined from international benchmarking using prices for similar services in countries that use a forward-looking cost-based pricing method. This involves the use of regression equation, derived from the international pricing data, to estimate monthly prices using distance and capacity as explanatory variables (Commerce Commission 2008a and 2008b).

A basic UBA backhaul service is subject to price monitoring only (Commerce Commission 2008b).

In regard to the benchmarking approach, it is notable that the Commission was unable to find data for 'comparable' countries to New Zealand, so in effect it was forced to rely on prices from countries with different characteristics in terms of population density and urbanisation:

> For example, in the UCLL STD, the Commission identified an initial set of 66 countries or US states in which UCLL services were available at forward-looking cost-based rates. Of those 66 jurisdictions, the Commission restricted its benchmarking analysis to 10 jurisdictions, based on a requirement that these jurisdictions exhibit similar cost drivers to New Zealand, such as population density and urbanisation. In terms of the UCLL Backhaul Service, none of the jurisdictions either used by the Commission in the draft UCLL Backhaul STD, or

by LECG in its submissions, correspond to the 10 jurisdictions that were found to be comparable for the purposes of the UCLL STD.[70]

Commercial-In-Confidence

Material Removed

[70] Commerce Commission, *Standard Terms Determination for the for the designated service Telecom's unbundled bitstream access backhaul*, (Decision 627), 27 June 2008, para 224. http://www.comcom.govt.nz//IndustryRegulation/Telecommunications/StandardTermsDeterminations/UnbundledBitstreamBackhaulService/ContentFiles/Documents/UBA%20Backhaul%20STD%20-%20Public%20Version.pdf.

Commercial-In-Confidence

Material Removed

4.5 CONCLUSIONS

In this Section of our report, we have reviewed the standard regulatory techniques for setting access prices (including both cost-based modelling and other methods), commented on how well they might apply to telecommunications transmission services and reviewed international experience on how regulation is applied.

Our review suggests there are significant implementation problems with all kinds of regulatory approaches to the pricing of transmission services – which was not necessarily unexpected. A range of different kind of regulatory approaches have been adopted overseas, perhaps reflecting a lack of consensus on both the need for regulation and the way it should be applied. Nevertheless, we can use this material to draw out a number of different options for regulating prices, which is the subject of Section 5.

5 Applying price regulation to transmission services

In this section, we return to the key questions asked by the ACCC in its brief:

- What pricing structures will create incentives for efficient investment in, and use of, transmission network infrastructure, and promote competition?
- Should cost-based pricing approaches be applied in determining a regulated price for transmission services? If so, what cost base should be used (e.g. forward looking or actual costs)? And what pricing methodology (e.g. TSLRIC, retail minus, utility style) should be applied? Should separate cost bases and/or pricing methodologies be used for different services and/or regions?

Our view is that, while is it possible to be conclusive about the pricing structure, at this stage it is helpful to present a number of options for cost estimation to determine the level of prices.

5.1 HOW SHOULD PRICES BE STRUCTURED?

In reiteration of the conclusions reached in Section 3, the key points that can be made in relation to a suitable structure of transmission prices are set out below:

- In the short run, costs of selling additional units of transmission capacity on existing networks is likely to be very low (low marginal costs). Transmission networks have extremely high potential capacity, so costs only need to be incurred to connect services and to add or augment optical equipment on existing lines.
- That also probably holds in the longer run over a narrow range of output (a single unit). However, over larger ranges of output, average incremental costs are higher in the longer run because they would include the costs of civil works, fibre and accommodation.
- There is broad consensus that the main cost drivers for transmission capacity services in the long run are capacity and distance, although to some degree the ring structure of transmission networks mitigates the effects of distance. This is supported both by overseas evidence and by analysis of prices charged on (more) competitive routes in Australia. There are other cost drivers, but it is difficult to tell how important these are likely to be or whether they can be substantively quantified.
- Service volumes will have a key bearing on the unit costs of transmission services for a given service, route or route aggregation given widespread economies of scale (especially in relation to civil works and fibre).
- Price structures that vary by both distance and capacity demanded should provide appropriate incentives for reasonably efficient use of infrastructure and efficient investment in infrastructure. The relationships between price and capacity should depend largely on the cost-volume relationship implied

by differences in equipment costs for higher capacity services. The relationship between price and distance is less clear, but the relationship could be derived from price structures on competitive routes.

- Prices should reflect cost causation. For example, ongoing maintenance costs should be charged as a rental charge whereas customer specific connection costs should be charged up front rather to the user rather than spread across all services as a rental charge – this avoids the possibility of long term consumers cross-subsidising short term consumers.

5.2 SHOULD COST-BASED PRICING REGULATION BE APPLIED?

The first threshold question is whether cost-based regulation is necessary to produce prices that are likely to promote efficiency and competition in dependent markets?

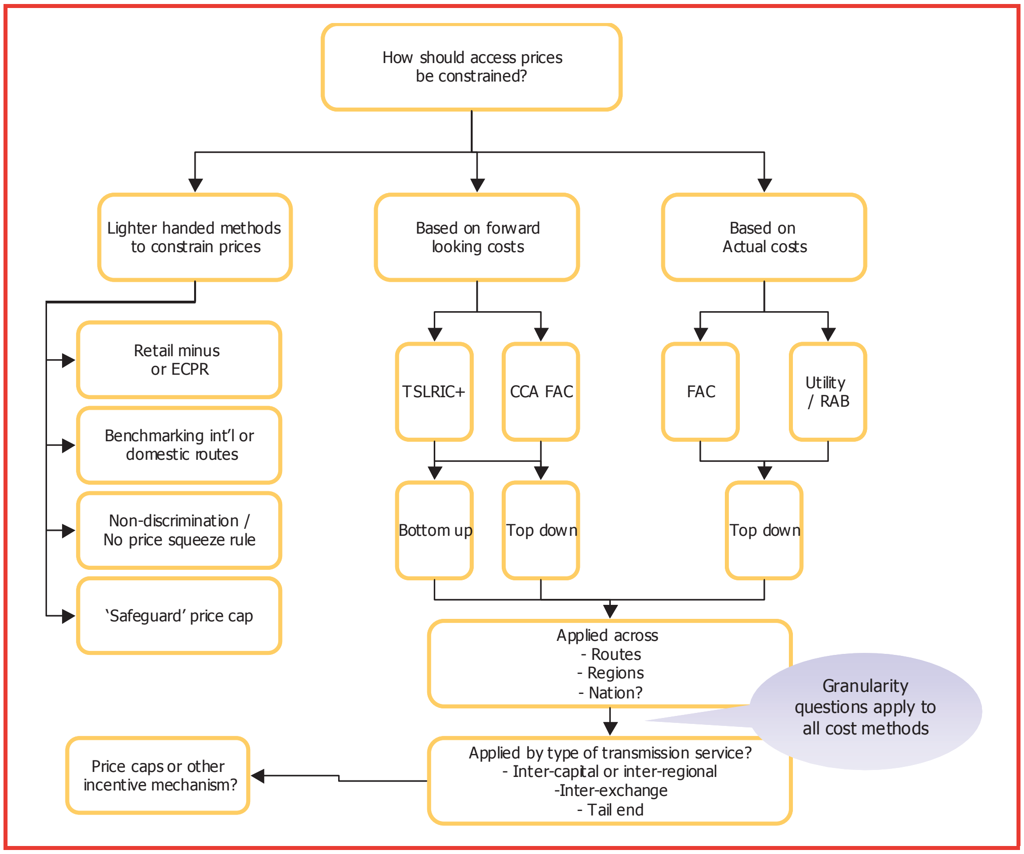

Figure 8: Summary of pricing options

Note: It is also possible to estimate TSLRIC using historic cost information.

A summary of the options as we see them is broadly represented in the above diagram.[71]

The set of options on the left hand side of this diagram represent the methods that may be used to regulate prices without seeking to directly measure or estimate the costs of the access provider. As discussed in Section 4, these options to regulate prices can have significant advantages either due to their lighter-handed nature, or because they are substantially easier to implement than cost estimation. However, in the current circumstances, these approaches do have some substantive limitations:

- First, transparency and regulation to prevent price squeezes addresses the problem of discrimination between internal and external supply of transmission capacity services, but does not address the core problem of high prices. Neither do safeguard price caps. Further, the difficult cost allocation questions that we have described in this paper do not simply go away under lighter-handed approaches – they are likely to arise again in developing a methodology to avoid price squeezes.
- Second, an ECPR approach suffers from similar limitations. The fact that many retail prices will be unregulated means that there are few guarantees that access charges will be constrained to efficient levels, or even 'reasonable' levels. This approach also would not be straightforward to implement as transmission capacity is likely to be a small part of end retail prices.
- Third, benchmarking of charges against services in jurisdictions that offer cost-based prices is inherently problematic given Australia's geography. It means there are likely to be few comparative countries against which to benchmark prices. Nonetheless, we see that benchmarking could well prove to be valuable in situations where it was not being relied on as the sole means by which charges were being set. In other words, it may be a useful complement to other cost-based measures. Benchmarking against domestic competitive routes seems more difficult. This is because competition is only likely to emerge in markets with a certain type of cost and demand structure – i.e. where fixed costs can be kept down or demand is relatively high. Applying these prices to routes where these conditions do not hold is likely to risk significant under-charging.

Based on the discussion above, it is our view that some form of cost-based pricing should be used in preference to reliance on the "light-handed" approaches described above. Having said that, it is undeniable that cost-based regulation is in itself a costly solution to deal with high prices. Even compared to other telecommunications networks, transmission networks are very complex, and aside from the direct costs to industry of developing appropriate costing methods, there is also a reasonably high risk of getting access prices wrong, with the prospect of (a) setting prices too high and facilitating recovery of monopoly profits, or encouraging inefficient bypass, or (b) setting access prices too low,

71 This does not consider difficulties with practical implementation of any of these approaches in particular settings.

damaging prospects for cost recovery or discouraging prudent investment by access seekers that would be highly beneficial in the longer term. This reinforces the view that it is desirable to focus price regulation on those services or markets most susceptible to use of market power.

5.3 WHAT COSTS SHOULD PRICE LEVELS BE BASED ON?

We have identified a number of different options if cost-based regulation is preferred:

- to continue with the Commission's existing approach of applying a bottom-up, forward-looking TSLRIC model to specific routes as needs arise (for example, if there is a requirement for arbitration);
- to seek to broaden the cost modelling exercise to cover broader increments;
- to move to a 'top down' TSLRIC costing approach based on forward-looking regulatory accounts, again on broader service increments; and
- to move to a 'top down' FAC cost approach based on historical regulatory accounts, again on broader service increments.

5.3.1 Continue with the existing approach of estimating the TSLRIC of a particular route on a forward-looking, bottom up basis

Putting to one side the general criticisms that may be made of TSLRIC costing (see 4.2.1), the ACCC's existing approach of applying bottom-up, forward-looking TSLRIC to particular routes seems appropriate at a conceptual level. It provides superior granularity to other methods, in that it allows for the costing of specific services. This reduces the averaging that must occur under methods that cost more services, and reduces the risk that prices will significantly diverge from cost.

However, our view is that this advantage is not as significant as it might seem, and that taking such a partial approach to TSLRIC is likely to run into serious difficulties at the implementation stage. These difficulties do not invalidate the approach, but they at least significantly offset any perceived conceptual advantages relative to other methods that would be less contentious to apply. These problems include:

- implementing a route-specific approach actually appears to require the design and costing of a network across a broader geographic region and supplying multiple transmission services, due to the basic ring design structure of efficient transmission networks[72];
- a wide range of inputs is required, most of which will need to be assessed for each individual route and have limited precedent value;

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72 See Appendix I of GQ-AAS, *op.cit.*

- the data is not reconciled to any real-world source of data, and cannot be reconciled to Telstra's regulatory accounts in their current form, meaning that potential modelling errors could be very large; and
- it would seem to provide very little ongoing certainty for access seekers or access providers as no prices may be set in advance of knowing the routes that one is interested in.

5.3.2 Estimate the bottom-up, forward-looking TSLRIC of a broader service increment

Under this approach, the cost of providing services on a forward-looking, bottom-up TSLRIC basis would be estimated. Prices for particular routes within the modelled region would be established by developing a price structure consistent with that outline in Section 3.7 – that is, a combination of connection, distance, capacity and potentially other charges.

While addressing the problems associated with estimating the costs of particular routes, in choosing a broader increment it is not straightforward to identify (a) broader geographic regions, and/or (b) broader service groups. In principle, one wants to identify clusters of routes that have similar cost characteristics. This will maximise efficiency-in-use and limit the degree to which incentives are created to inefficiently bypass Telstra in more competitive areas. Further, it is desirable to capture all similar routes or services that use common infrastructure. This does not avoid the cost allocation problem (i.e. how to split the common costs between services), but it does ensure that all common costs are allocated, whatever methodology is adopted.

Conceptually, modelling could be done:

- by estimating costs across Australia or separately within states (which we understand form the natural boundaries for transmission networks);
- by type of service – i.e. inter-capital, capital-regional, inter-exchange and tails across the identified region; or
- by separately costing non-competitive routes.

Once a relevant service and region is determined, the structure of prices can then be determined (i.e. set capacity and distance charges to recover relevant costs). These prices would apply within that service or region, but may vary across services or regions.

It does not appear possible to cost competitive and non-competitive routes separately. This is primarily because it appears that there may well be considerable network sharing between these routes (it seems that particularly capital-regional and inter-exchange routes contain a mix of competitive and non-competitive services).

That said, the problem of costing across non-competitive and competitive routes is largely unavoidable (it may be avoidable in the case of tail-end transmission, which we understand is predominately uncompetitive). The issue will therefore be how the overlap is handled. There are two main options:

- the first would be to cost all routes, but only set prices for non-competitive routes, which will require costs to be allocated between competitive and non-competitive routes. (Costs will likely be allocated by some usage-based driver such as capacity or route distance).
- the second option would be to cost all routes, and allow prices to be set to allow for cost recovery overall (without setting individual route prices). No cost allocation would then be required but it is likely that the access provider will set prices to reflect different competitive pressures (higher prices on less competitive routes).

5.3.3 Estimate the forward-looking TSLRIC of transmission services across a broader service increment on a top down basis

The costing approach taken in UK and in other parts of Europe appears to primarily be based on regulatory accounting data, with separate types of transmission services identified but with broad levels of geographic averaging. For example, BT's regulatory accounts identify the costs of symmetric broadband origination and trunk segments, including breakdowns of individual cost components (such as connections, ends and links etc) for the applicable types and capacities of services supplied (traditional or alternative interface, 2Mbps etc).[73] There is no geographic disaggregation of the accounts (although, as discussed earlier, there is a regulatory exemption for the centre of London and some flexibility to geographically de-average trunk segment prices).

Applying this approach to Telstra as the access provider would require a significant change to Telstra's regulatory accounts. Having examined the structure of the BT accounts, and compared these to the structure of the Telstra regulatory accounts outlined in the Regulatory Accounting Procedures Manual (RAPM) pertaining to transmission services,[74] it is apparent that to produce robust top-down TSLRIC estimates would require both further horizontal disaggregation (into more than just declared 'transmission capacity services' and into the separate services like tail ends, etc and including the capacities of the different services sold on each) *and* further vertical disaggregation so that the transmission cost line items could be more accurately assigned or assessed against these services.

We also understand that the ACCC receives current cost accounting information, pursuant to the current cost accounts record keeping and reporting rules. These are historic costs indexed by various price indices (e.g. labour prices, material price index) rather than direct or MEA valuations. Before using these accounts for price setting, it may be necessary to re-visit the application of these accounts, particularly to examine the potential for the accounts to exclude relevant assets and include redundant assets (including fully depreciated assets).

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73 See Section 4. The BT regulatory See BT, *Current Cost Financial Statements for 2008 including Openreach Undertakings*, Section 6.

74 ACCC, *Telecommunications Industry Regulatory Accounting Framework*, 2003, pp. 46-50.

A further issue that remains is the appropriate geographic disaggregation of the cost estimates. This is a difficult issue to be definitive about. Broadly, we would expect that a grouping of routes into similar services and developing a pricing structure that addresses both distance and capacity as the key cost drivers should provide sufficient pricing granularity so that Telstra can recover its costs (and noting that Telstra already appears to average prices across competitive and non-competitive areas for certain types of services, as described in Section 3.4 above).

The major advantages of this approach are that:

- it would allow TSLRIC to be determined on the basis of Telstra's accounting information, thereby reducing the discretionary nature of the costing exercise compared to a bottom up method;
- it should provide a clearer trail of where common costs have been allocated and therefore provide more confidence that, overall, the allocation approach was consistent with cost recovery but no more; and
- It would allow the ready derivation of a structure and level of prices that broadly reflected costs that could be widely applied to specify prices for individual routes based on service type capacity and distance as needed.

The major disadvantages appear to be that:

- it would imply a major shift away from the calculation of TSLRIC as practised by the ACCC with respect to other fixed and mobile services (viz. Analysys Mason fixed cost model and WIK mobile cost model); and
- it would require a significant amount of resources to ensure that Telstra's regulatory accounts were in a state sufficient to derive efficient prices from them. This would need to be done in advance of any particular dispute or undertaking.

5.3.4 Estimate the FAC of transmission services across a broader service increment on a historical cost basis

Under this approach, the cost of providing services would be based on Telstra's actual costs incurred. These could be derived from its regulatory accounts.

As described in Section 5.3.2 above, however, decisions still need to be made about the appropriate areas or regions (whether Australia wide or within states) and whether different transmission services should be disaggregated. Again, once a relevant service and region is determined, the structure of prices can then be determined (i.e. set capacity and distance charges to recover relevant costs). Further work to disaggregate Telstra's accounts would clearly be needed to make this a useful exercise.

In contrast to bottom up LRIC and other forward looking modelling approaches discussed above, using historical cost might be more objective (being able to draw on regulated accounts for source data) and less prone to error and price variability than bottom up modelling. It should also ensure that Telstra will be able to recover its actual costs and hence provide good incentives for further investment. Incentives for cost minimisation would obviously be less strong than under a forward-looking or bottom up approach. However, the use of price caps or other kinds of incentive regulation can potentially address these deficiencies.

5.3.5 Adopting a mix of pricing approaches

The four costing alternatives considered above were considered as discrete alternatives. However, it may be possible to apply the different costing alternatives and/or other types of less intrusive regulation to discrete types of transmission capacity services.

One rationale for adopting a mix of approaches would be to reflect the different demand and supply conditions of transmission capacity services. In particular, it would seem desirable to impose less intrusive or 'light touch' regulation in areas that are prospectively competitive (i.e. for routes or services in which some entry has already occurred or seems highly likely to occur), and to reserve cost-based methods for where there are discrete markets in which competition seems unlikely.

Introducing lighter handed price regulation

To provide an example of how this approach might work, we consider the following three types of markets:

- markets which are effectively competitive;
- markets in which there has been at least one entrant or there is prospective competition; and
- markets which are a monopoly and are likely to remain so.

Competitive markets would be excluded from pricing regulation. We understand that the ACCC has taken the view where there are at least three infrastructure-based entrants, markets are likely to be effectively competitive.[75]

In markets where there has been at least one entrant (a duopoly), a 'light handed' approach might adopted on the basis that if the market can support one entrant, it may well be possible for this market to become effectively competitive over time. A possible light-handed regulatory response might be to impose a safeguard price cap of CPI – 0, that is, allow for no real price increases over time. This would limit the degree to which the ACCC would have to enter into cost modelling debates in those areas where its application is likely to be most problematic – where it may undercut the prices of an existing competitor to Telstra.

In markets where there is no current or prospective competition, one of the cost-based methods could be chosen. We discuss which method in Section 5.4.

The multi-layered regulatory approach would have some desirable properties – particularly as it should preserve incentives to invest in areas where such

75 See e.g. ACCC, *Transmission Capacity Service - Review of the declaration for the domestic transmission capacity service*, Final report, April 2004.

investment has already occurred – and focuses more heavy-handed regulation on enduring bottlenecks.

There might be some practical issues with such an approach. One problem would be how to apply the costing approach in those areas where there is a mix of competitive, prospectively competitive and non-competitive services. As we discussed in Section 5.3.2, deriving prices for non-competitive services will entail the allocation of some common costs to competitive and prospectively competitive services, or alternatively (if costing just the non-competitive routes), the issue will be how much common cost is recovered from non-competitive services. That said, it is not clear that a third type of service category adds to the costing problems that already arise from costing across a mix of competitive and non-competitive routes.

In addition, such problems would not be so significant for services using parts of the transmission network that are mostly separable from other areas. For example, and as we note above, it seems that the competitive conditions of supply for tail-end transmission is fundamentally different from the supply of inter-capital and capital-regional transmission services. This is reflected in the ACCC's recent decisions on Telstra's DTCS exemption applications and is also consistent with the experience in overseas jurisdictions, with (a) the European Commission identifying 'trunk' and 'terminating' segments as separate markets, and (b) many European authorities deregulating trunk markets or reducing the regulatory obligations in these markets.

Using multiple cost-based pricing methods

A second kind of rationale for using multiple pricing methods would be to improve on the accuracy of results obtained under a single costing approach. One particular issue with the route-specific TSLRIC model is that it cannot currently be reconciled with real-world data from Telstra's regulatory accounts. Although a full reconciliation may be difficult, it may be possible to compare results generated by the TSLRIC model with (a) more granular regulatory accounts, or (b) benchmarks generated by comparisons with domestic and / or international routes of similar distance and with similar capacity demand characteristics.

5.3.6 Encouraging efficiency over time

An important part of any pricing approach is the incentives it gives for the firm subject to pricing regulation to behave in a dynamically efficient way. By this we mean that the firm should face incentives to minimise its costs and to maintain or expand its investments to meet changing market demands.

A TSLRIC costing approach is said to provide incentives for efficient behaviour because it is only 'efficient' costs that are allowed to be recovered. TSLRIC modelling commonly involves some kind of optimisation procedure (whether bottom up or top down), and the adoption of forward-looking costs. These models also generate a price path over time that allows for recovery of the efficient costs (typically using tilted annuities or economic depreciation estimates). There are no standard practices as to how often these estimates of costs need to be renewed or reviewed, although it typically ranges between three and five years. We see this as very much being a 'stick' approach, as the firm has effectively no ability to outperform the benchmark measure.

As described in Section 4.2.5, price caps are another mechanism that is widely used to promote dynamic efficiency. These are widely seen as providing rewards for efficiency and innovation that results in cost reductions, as they allow the firm to keep any excess returns if they can 'beat' the price cap (the 'carrot' approach). Price caps can be used in conjunction with any type of costing methodology (as the costing methodology will usually just set the desired access price at a point in time), although it seems better suited to be used as a complementary measure for costing approaches that do not explicitly take into account inefficiencies deriving from network architecture or use of historical cost asset valuations.

5.4 CONCLUSIONS AND RECOMMENDATIONS ON COSTING AND PRICE LEVEL ISSUES

We have now identified a number of different options for regulating price levels for transmission capacity services, and we now turn to the decisions that need to be made to identify a preferred approach.

The first decision that needs to be made is on the desirability of using different pricing approaches for uncompetitive (monopoly), prospectively competitive (duopoly) and competitive services.

Our view is that it would be preferable to use different pricing approaches to account for differing degrees of competition. In particular, a lighter-handed approach could be used where there has been some competitive entry. This would reduce reliance on cost modelling and encourage facilities-based competition.

The second decision is what costing and pricing approach to apply to those routes which are monopoly routes and are expected to remain so. Our discussion of the options suggests that there is no costing approach that is always more appropriate than the others in all circumstances; rather, a decision will need to be made based on the analysis of the characteristics of the costing approach considered most important to the ACCC.

In the following table, we summarise our views as to the relevant factors (based on the list of four factors presented in Section 4) and the merits of each kind of costing approach.

Table 8 Applicability of costing approaches to transmission capacity services

Factor	Bottom up TSLRIC		Top down TSLRIC	CCA FAC	HCA FAC
	Narrow increment	Broad increment	Broad increment		
Granularity – ability to cost routes separately & minimise averaging concerns	High	Accounting approaches inherently have less flexibility than bottom up models, but broader bottom up modelling will also encounter this problem			
Potential for common cost over-recovery	High	Low - Accounting approaches *or* TSLRIC modelling of a broad increment can counter this problem			
Amount of work required before disputes / undertakings	Low	High – it will be too difficult to apply these approaches only once disputes arise or undertakings submitted			
Incentives for new investment	Costing approaches that do not re-value assets or optimise the network when costing are likely to best encourage investment, as they reduce the risk of asset stranding. However, these approaches do not best promote efficient 'build or buy' decisions by access seekers, and so can encourage inefficient bypass.				
Incentives for use of existing infrastructure	Costing approaches that re-value assets and optimise networks are likely to best encourage efficient use as these approaches take into account value of productive capacity required to meet access requirements.				
Certainty for access provider and access seekers	Low – as costing will be specific to particular dispute	Moderate – as costing information could be readily used in more than one dispute			
Consistency with other costing approaches	High – viz. mobile cost model and fixed cost model		ACCC has not tended to favour these approaches in the past		

We consider the decision whether to use a forward-looking bottom-up costing approach is finely balanced. On the one hand, one might expect transmission capacity services might be subject to some inefficiencies in supply, which forward-looking modelling could counter. On the other hand, the possibility of bypass may be of little practical significance for certain transmission capacity services, particularly those in regional areas, and so there may be little benefit in choosing a costing methodology on the basis that it promotes efficient 'build or buy' decisions. Costing approaches based on historical costs and incorporating a price cap could equally provide for opportunities for the access provider to earn a return on investment, together with incentives to minimise costs (to a degree this will depend on how the 'X' in the price cap is set). Alternatively, a hybrid approach where bottom-up LRIC modelling results are reconciled with top down CCA modelling results could also help to ensure that the estimated costs better reflect the costs incurred by the access provider.

Our view is that bottom-up TSLRIC modelling would be better suited that other approaches producing estimates at the route or region level. However, our view is that some further aggregation of costing above the route level is necessary, primarily because it would increase the reliability of the costing (particularly with respect to common costs). It should also provide for greater certainty for access providers and access seekers, as the results of the costing will be more broadly applicable (i.e. to more than just the route that is the subject of dispute).

We can envisage some circumstances in which a route-specific (or region-specific) approach to costing may remain necessary. However, it would better to use this kind of approach in conjunction with a more aggregated cost estimates to ensure that prices produced are reasonable within the context of the cost of the entire transmission network (or subset of relevant transmission network services). It may be useful to use this hybrid approach for routes with atypical characteristics, such as being longer and less-trafficked than the 'average route' costed.

Our view is that using multiple sources of cost information to set prices would be the best approach. This could include a combination of bottom up TSLRIC modelling with CCA FAC regulatory accounting information, but could also include international and domestic benchmarks (this will depend on the specific route or service at issue).

The next decision is *how* to best aggregate routes so as best to manage the trade-off between the benefits and problems of costing granularity.

One approach would to cost all types of transmission services as the one service. A second approach would be to split services along the lines of the ACCC's classification described in Section 1 (Inter-capital, Capital-Regional, Inter-exchange and Tail-end). A third approach would be more akin to the European approach, with separates 'trunk' from 'terminating' transmission segments (roughly speaking, we understand this would involve grouping inter-capital with capital-regional as 'trunk' services, and grouping inter-exchange and tail-end services as 'terminating' services).

A subsequent issue then is whether these services should also be disaggregated into regions (e.g. by state or by metropolitan/regional areas).

Our view is that the 'trunk' and 'terminating' approach to service aggregation is likely to prove easier to develop and apply that either the broader 'all services' approach or the narrower 'each service' approach to costing.

- While it would be desirable to cost 'trunk' services on a national level, it may be necessary to cost particular routes or states separately if certain routes *or* states are likely to have much higher costs of supply.
- Our initial view is that it may be necessary to separate 'terminating segment' services into geographic bands (perhaps similar to those used for ULLS). The inter-exchange links will likely have similar cost drivers across different regions and cost differences relating to distance should be reflected in the price structure. However, we understand that tail-end segments may not have separate distance-based charges, even though the average distances may differ depending on region (i.e. CBD or Band 1 areas would likely have lower average cable lengths). Further analysis would be needed to confirm this approach (e.g. of Telstra's existing price structure for tail-end services).

If regulatory accounting data is to be used (as we recommend), consideration must be given to the disaggregation of Telstra's existing regulatory accounts. It will likely be too burdensome for Telstra to report regulatory accounting data down to the level of routes, but at the exiting level of aggregation, the regulatory accounts provide little or no useful information for the purpose of setting or comparing prices.

Our view is that, at a minimum, Telstra should be required to separately report costs and revenues for different types of transmission capacity services (e.g. trunk/terminating). Further geographical disaggregation for terminating services would also be desirable (as described above), and further vertical disaggregation of the accounts will also be necessary to analyse the efficiency of proposed price structures.

Having decided on a regulatory costing approach, it is also necessary to consider how to apply this to particular routes where the costing approach covers a mix of competitive and non-competitive services (discussed in 5.3.2). In particular, this will likely involve some cost allocation between competitive and non-competitive services.

Our view is that the approach of allocating the cost according to a relevant cost driver such as share to total capacity and/or share of total distance is likely to be the best in the circumstances. The allocation rules should be approved by the ACCC to ensure they do not disproportionately load costs on to non-competitive routes.

Annex A – Summary of international approaches to the pricing of transmission-type services

Country/jurisdiction	Service or service group	Type of wholesale pricing regulation applied	Structure of wholesale prices
United Kingdom (Ofcom 2004)	High and low bandwidth TISBO	Cost orientation (FL-LRIC) and RPI-X regulation Geographic discounting permitted but not allowed to contribute to meeting charge control	Charges split between circuit connection, circuit rental (local end and main link), third party infrastructure and point of handover charges Upfront connection and equipment fees where equipment specific to buyer Fixed and distance related rental charges Geographic discounting only applied in Central London
	Wholesale trunk segments	Cost orientation (FL-LRIC)	
	AISBO	Cost orientation (FL-LRIC)	
Ireland (ComReg 2008)	Terminating segments of wholesale leased lines (includes intra-urban routes where competition is limited)	Cost orientation (FL-LRIC)	Charges split into connection gees, fixed rental fees and per kilometre charges. Prices do not vary by location
United States	High speed data transmission including Ethernet, optical networking, Frame Relay and ATM.	Must be made available by ILECs on wholesale basis to other operators on "just, reasonable and non-discriminatory rates and terms", but no specific tariff regulatory mechanisms apply (Maxwell 2007).	E.g. AT&T California 10Gbps "DecaMAN" intraLATA dedicated high capacity transport service. Upfront charges, monthly fixed

Country/jurisdiction	Service or service group	Type of wholesale pricing regulation applied	Structure of wholesale prices
			and monthly per mile charges apply. Separate diversity and protection chargers apply. Rates are lower the longer the contract commitment. (AT&T 2009).
	"Special access" services including high-capacity (DS1 and DS3) fibre loops and backhaul in TDM format.	ILECS musts make available to under non-discriminatory public tariffs to competing operators and enterprise end-users. Generally tariffs subject to price cap regulation (not cost-based), whereby weighted average price for a basket of services must be no greater than the price during the previous year with adjustments for inflation and productivity (ie CPI-X regulation). However, greater flexibility permitted depending on number of fibre collocations, extent to which CLECs use alternative backhaul (including volume and term discounts, contract tariffs, and in most competitive areas removal from price caps altogether). (Maxwell 2007).	E.g. Verizon New York inter-office transport mileage for DS1, DS3, STS-1 and OCn comprise a fixed monthly fixed charge and a montly per mile charge. For inter-office transport entrance facilities (for transport between the requesting carrier's switch location and Verizon's serving wire centre) there is a monthly fixed charge and a monthly charge per ¼ mile. Separate ordering, provisioning and multiplexing charges apply. (Verizon 2009).
	Wholesale DS1 and DS3 fibre loops.	TELRIC, but only in those wire centres where CLECs are considered to be "impaired" without access to these facilities. Thresholds for absence of "impairment" are defined as those for which there are a certain number of fibre connections and/or level of line density. Above these thresholds access is still required but under the terms for "special access" described above (Maxwell 2007).	E.g. Verizon New York "High capacity links". Line conditioned for 1.5Mbps a monthly charge that varies by density zone; a line conditioned for 45 Mbps a monthly charge that varies by density zone plus a charge per ¼ mile. (Verizon 2009).

Country/jurisdiction	Service or service group	Type of wholesale pricing regulation applied	Structure of wholesale prices
Canada	Low speed competitor digital network (CDN) DS-0 and DS-1 access.	Defined by CRTC as "conditional essential" under revised regulatory framework. For ILECs other than Telebec and TCC in Quebec, prices are determined according to company specific prospective incremental costs (termed Phase II costs) plus a mark-up of 15 per cent. In the case of Telebec and TCC the same pricing principle applies but the mark-up is 25 per cent. (CRTC 2008, paras 124, 134). Price cap regulation of inflation less productivity (I-X) applies for services not exempted previously.	E.g. Bell Canada. CDN monthly access rates differ by bandwidth and exchange bands. Service order charges apply which rise with capacity. (Bell Canada 2009)
	Co-location (incl. IC-to-IC cross connection), CO connecting links, dedicated access lines, aggregated ADSL and third-party internet access.	Defined by CRTC as "conditional mandated non-essential" under revised regulatory framework. Pricing on the basis of Phase II costs (defined above) plus a mark-up of 15 per cent (CRTC 2008, paras 124, 137). Price cap regulation of inflation less productivity (I-X) applies for services not exempted previously.	
	Interconnection between LECs, between LECs and long-distance networks and between LECs and wireless service providers; transiting services for local, toll and CCS7 services; and dialled number transport capability.	Defined by CRTC as "interconnection" under revised regulatory framework. . Pricing on the basis of Phase II costs (defined above) plus a mark-up of 15 per cent (CTRC 2008, paras 124, 142). Price cap regulation of inflation less productivity (I-X) does not apply if I is less than or equal to X. If I is greater than X ILEC may file applications "as appropriate". (CTRC 2008, paras 143-149).	
	Low speed CDN transport between ILEC central offices	Defined by CRTC as "non-essential subject to phase out" under revised regulatory framework. Phase-out	E.g. Bell Canada CDN metropolitan inter-exchange

Country/jurisdiction	Service or service group	Type of wholesale pricing regulation applied	Structure of wholesale prices
	(DS-0 and DS-1); fibre-based access and transport services including CDN DS-3, OC-3, OC-12 and Ethernet access; intra-exchange and metro interexchange transport; and CO channelization; Ethernet transport.	periods of between 3-5 years are specified. Pricing on the basis of Phase II costs (defined above) plus a mark-up of 15 per cent. Price cap regulation of inflation less productivity (I-X) applies Negotiated rates (competitor agreements) are permitted which do not require CRTC approval, although the CRTC reserves it right to deal with instances of unjust discrimination or undue preference (CRTC 2008, paras 162-166).	channel service comprises a monthly charge per mile that varies by bandwidth. Service order charge also applies. (Bell Canada 2009) E.g. Bell Canada Ethernet Network Paths. Monthly rates which vary by capacity and for Metropolitan, Provincial and Regional locations. (Bell Canada 2009)
New Zealand	Unbundled copper local loop (UCLL) backhaul service; and Enhanced unbundled bitstream access (UBA) backhaul service	Regulated under Standard Terms Determinations (STDs). For UCLL backhaul applies only to those routes where Telecom faces "limited competition". Pricing on the basis of international benchmarking using prices for similar services in comparable countries that use a forward-looking cost-based pricing method. Use of regression method to estimate monthly prices using distance and capacity as regressors (Commerce Commission 2008a and 2008b).	Key charges are connection charge per end, and monthly rental rates that vary by distance/distance range and by capacity of service.
	Basic UBA backhaul service	Price monitoring only (Commerce Commission 2008b).	

Table 9: Summary of international transmission regulation

Annexe B – Stylised price structure example

Although the example makes loose reference to BT's regulatory accounts, the GQ-AAS cost model and the ACCC's Regulatory Accounting Procedures Manual (RAPM), the cost categories in particular have been simplified for ease of illustration. The model should therefore not be regarded as an actual template to be used directly to derive transmission prices.

In reference to the top table in Figure 7, the example assumes that there is a cost pool (in the gold column) for each of the different transmission cost components/line items (listed in the yellow column). The cost pool for each line item needs to be allocated to the different speed transmission services (hereafter "services") listed across the top of the table. In order to do this consideration is given to the "primary cost drivers" of the line items (first green column), which are in turn used to specify a "cost allocator" for each (second green column) that is used to allocate the cost pool for each line item to each service. For connection costs, the cost allocator is the share of connections, for civil works and accommodation the share of circuit kilometres (sum of the distance of all circuits) and optical equipment the number of circuits operating. These costs allocators are derived from the "Unit" information that is contained in the second table, with the arrows indicating which units are used to derive which cost allocators. In respect to the card and port costs in the first table, it is assumed that there are separate cards that are used for lower capacity services (10 Mbps and below) compared to higher capacity services (above 10Mbps). Hence the costs allocators are used only to allocate the cost pools that have been allocated directly to the lower and higher capacity services. This difference in approach is highlighted by the dark yellow cells in the first table. The cost allocators are used to allocate the cost pools for each service to the green and dark yellow cells in the first table.

To convert the costs for each of the line items in the first table into the prices in the third table, the relevant line items that make up the costs for "Connections", "Monthly rental" and the "Monthly per km charge" are summed vertically and the resulting values divided by the units in the second table (and by twelve for the monthly charges assuming the cost data is annual). Examples for each of the prices are illustrated by the vertical arrows extending through the three tables for with respect to the 2, 8 and 10 Mbps services.

Lastly, the bottom table illustrates for the 34/45 Mbps service how to derive a total monthly charge for a particular route, based on the prices derived in the previous step. This is calculated by adding the monthly rental charge to the monthly per kilometre charge multiplied by the radial distance of the route. Reflecting the cost structures in the first table and the method of unitisation of costs to form prices, these charges are increasing to speeds of service and the radial distance of a route.

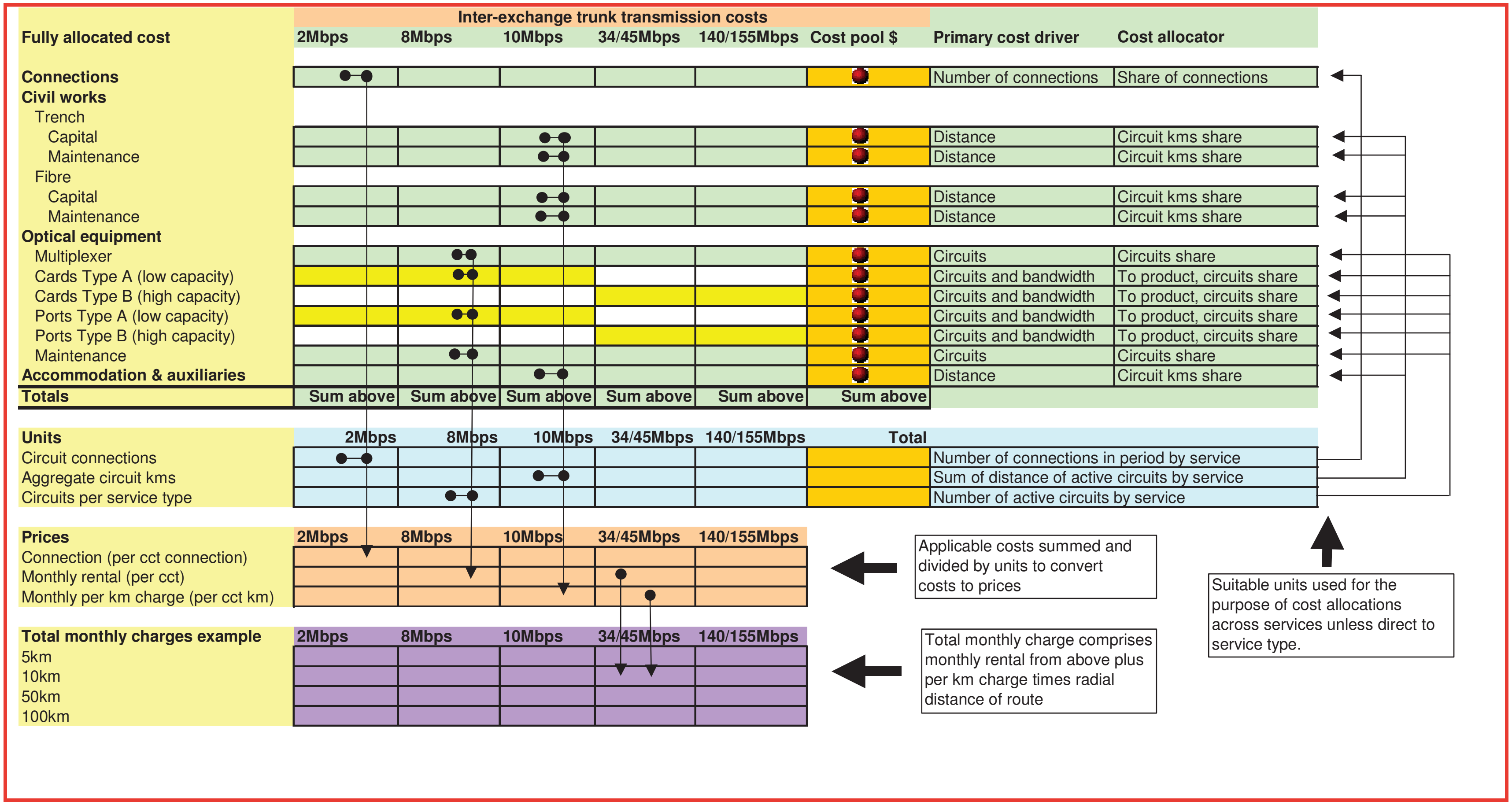

Figure 9: Derivation of transmission prices from costs

Source: Frontier Economics

Annexe B – Stylised price structure example

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