Regulating Interconnection Pricing

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[A] Introduction

Interconnection in telecommunications is a special case of a more general economic problem of infrastructure access. Issues of access arise when one or more firms each control upstream facilities that provide a good or service that is needed for further downstream production. Other firms seeking to enter the downstream market must either purchase the relevant upstream input from one of the firms, or produce the upstream input themselves.

Of course, this situation characterises almost any vertical production chain. But this does not normally lead to concern. If there are a reasonable number of upstream firms, each of whom can provide the relevant input, then competition will ensure that potential downstream firms can buy the input at a reasonable price. Access to an essential input only gives rise to an economic problem if there is inadequate competition at the upstream production stage.

At any time there are numerous markets in an economy where it might be felt that competition is below some desirable level. However, it is not necessarily desirable to immediately intervene in such markets through the use of, say, price controls. Regulation has its own costs and if any lack of competition is transitory, then it is likely that these costs will outweigh any benefit. Further, regulation might exacerbate competitive problems. If an industry is subject to intrusive regulation, then this may prevent firms from making profits that will attract new entry. In many markets, it is better to allow competition to develop naturally.

In this sense, access to an essential input is only a cause for specific regulatory intervention if it is either highly unlikely that competition will develop in the upstream

market in the longer term or if such competition is itself undesirable. In general, this means that the upstream production process involves a natural monopoly technology.

[B] Natural monopolies

A natural monopoly technology exists if, at all relevant levels of output, it is more efficient (in terms of lower production costs) to have the output supplied by a single firm than by more than one producer.[1] In such circumstances, it is economically undesirable for there to be competitive supply in the sense that *given a level of output*, the costs of having two or more firms produce that output is higher than if only a single firm produced that output. The existence of a natural monopoly technology is an empirical question, although such technologies are most likely to arise where production involves fixed costs that are large when compared with marginal costs. Further, the existence of a natural monopoly technology depends on the extent of demand. As demand for a product grows, it may become economically desirable to divide the increased production between different producers.

If production involves a natural monopoly technology, then this does not mean that competition in production is impossible. Rather it means that this competition is inefficient in the sense that total output is not produced at minimum cost. Whether competition between two or more firms can arise for a product that involves a natural monopoly technology depends on the nature of interactions between the relevant firms. In particular, such competition, if it exists in the longer term, is likely to be muted.

In telecommunications, it is often argued that certain parts of the fixed line network involve a natural monopoly infrastructure. In particular, it is often argued that the copper network that connects individual residences and businesses to the telecommunications network is a natural monopoly. In Australia, this Customer Access Network (CAN) is predominantly owned by Telstra. Any other telecommunications carrier wishing to provide telecommunications services to customers who are connected to Telstra's CAN must be able to access that facility. This access is required to both originate calls from a calling party and to terminate calls to other parties connected to the Telstra network. Thus, a carrier wishing to provide, say, long distance fixed line telephone services between Sydney and Melbourne needs to purchase both originating

and terminating access from Telstra in order to complete calls. From the carrier's perspective, it is only able to compete in the retail market for long distance calls if it can purchase the upstream access services to the CAN.

Whether or not the CAN is a natural monopoly is an empirical question. As already noted, when demand for a service expands, an industry may move from natural monopoly to efficiently supporting alternative competitive suppliers. Thus, as demand for telecommunications services grew over the 20th century, debate about both the existence and extent of any natural monopoly in fixed line telephone networks also grew. For example, there is conflicting evidence as to whether other parts of the Public Switched Telephone Network (PSTN) in addition to the CAN involve a natural monopoly.[2] Further, as technology changes, effective competition may become viable in natural monopoly industries. For telephone services, the introduction of wireless services, digital transmission and optical fibre networks have radically altered the nature of phone calls. It is not clear whether these new services either extinguish existing natural monopolies or are themselves natural monopolies.[3]

That said, most telecommunications interconnection regulation in Australia and around the world has been predicated on the view that significant parts of the fixed line PSTN involve a natural monopoly and that (at least in the short-term) competition in retail telephone services will be improved in an economically desirable way if interconnection is mandated and the price of interconnection services is regulated.

[B] One-way and two-way interconnection

This standard approach leads to a *one-way interconnection* problem. Carriers wishing to compete at the retail level need access to the ubiquitous fixed line network. However, as competing telecommunications networks develop, particularly through the integration of voice and data services and the development of wireless services, a problem of *two-way* or *network-to-network* interconnection develops. If there are competing telephone networks, then interconnection between these networks is necessary in order for a customer who subscribes to one network to connect to an individual subscribed to a different network. Thus, mutual or reciprocal interconnection is required in order for each network owner to provide a ubiquitous telecommunications service.

Two-way interconnection problems are increasingly drawing the attention of regulators. For example, two-way interconnection issues have been raised regarding internet 'peering' and for mobile phone networks.[4] A dominant carrier or group of carriers may seek to impede efficient entry by refusing to provide interconnection to a new entrant or by setting differential interconnection pricing for different competing networks. Two-way interconnection pricing may also be used as a collusive device to limit competition between networks for new subscribers.

Regulatory issues relating to two-way interconnection are likely to grow over time. For example, traditionally, mobile telephones have been viewed as a complement to fixed line telephones: '[T]he advent of the mobile has, to a significant degree, expanded the market for making calls, rather than substituting for fixed calls, implying that a large majority of mobile calls are complementary to fixed calls.'[5] Recent research, however, suggests that as mobile telephones become more widely adopted, they become a substitute for fixed lines. For example, see Cadima and Barros[6] and Rodini, Ward and Woroch.[7] Sung and Lee[8] use Korean data and estimate that a 1% increase in the number of mobile telephones results in a reduction of 0.10–0.18% in new fixed line connections and a 0.14–0.22% increase in fixed line disconnections. As mobile and fixed line services compete directly through network competition, regulatory issues relating to two-way interconnection between these networks will become increasingly important.

In this chapter we focus on the economic issues of one-way interconnection pricing, reflecting the dominance of such regulation in most countries including Australia. We first consider how fixed line origination and termination access services have been regulated both in Australia and overseas. In particular, we consider the total service long run incremental cost (TSLRIC) approach that is preferred in Australia and Europe. We then consider the issue of the 'access deficit' that has arisen in Australia, focusing on the economic basis of any access deficit contribution through interconnection pricing. Finally, we turn our attention to the problems of mobile termination regulation. Australia and the United Kingdom have been world leaders in both the research of mobile termination and the understanding of appropriate regulation. Further, mobile termination begins to introduce issues of two-way access and an analysis of mobile termination

services provides insight into the future direction of interconnection regulation in telecommunications.

[A] Interconnection and price regulation

The goal of interconnection pricing is to ensure the long-term development of telecommunications by striking a balance between the preservation of competition and the encouragement of investment in key infrastructure. In this regard, economists have debated the appropriate basis for interconnection pricing; in particular, the precise method by which regulators can determine such prices and charges.
As Laffont and Tirole note:

[quote] [t]he dominant paradigm in current regulatory reforms is that of 'forward-looking long-run incremental cost,' … This paradigm was taken up in 1995 by Oftel in the United Kingdom and in 1996 in the *Telecommunications Act* and the FCC order in the United States; it is also advocated in the 1994 WIK/EAC report commissioned by the European Union.[9] **[end quote]**

[FO] There are, however, two different approaches to this paradigm. The first, TSLRIC, has been advocated by the Australian Competition and Consumer Commission (ACCC) in its guidelines on a variety of telecommunications interconnection issues.[10] In contrast, the Federal Communications Commission (FCC) in the United States has proposed TELRIC pricing for discrete elements forming part of a larger regulated network (referred to as 'unbundled network elements').

In this section, we consider the economic basis of TSLRIC access pricing, its relationship to alterative cost concepts such as marginal and common costs, and the differences between TSLRIC and TELRIC. We conclude by considering the 'retail minus' approach to pricing that has also been used in Australia, in relation to the wholesale supply of local calls.

[B] Total service long run incremental cost

The concept of TSLRIC is derived from the theory of costing for multi-product firms. This theory developed in the late 1970s and early 1980s to deal with inadequacies when common cost concepts were applied to multi-product firms.[11] To fully appreciate the concept of TSLRIC, it is important to briefly review these basic cost principles.

[C] Cost concepts and TSLRIC

Economists describe an (efficient) firm's technology by the type of costs that the firm bears when it produces its output. Broadly speaking, economists break costs into fixed costs and variable costs: '[s]ome costs, called fixed costs, do not vary with the quantity of output produced.'[12] In other words, these are costs that the firm must bear when it produces a positive quantity of output but these costs do not change as the exact level of the firm's output changes. In contrast, '[s]ome of the firm's costs, called variable costs, change as the firm alters the quantity of output produced'.[13] Total costs are simply the sum of all fixed and variable costs.

A cost that is of key importance to much economic analysis is marginal cost. 'Marginal cost tells us the increase in total cost that arises from producing an extra unit of output.'[14] Two important features should be noted about marginal cost. First, it only considers an increase in output by one unit. Second, the concept of marginal cost can be applied to a firm regardless of whether the firm produces only one product or the firm produces a variety of products. Of course, for a multi-product firm, the marginal cost of one of its products will generally differ from the marginal cost of another of its products.

Marginal cost can be contrasted with average cost. For a firm that produces only a single well-defined product, average total cost is the total cost of production divided by the total quantity of output. It is also possible to define average fixed cost and average variable cost. Average cost however usually cannot be uniquely defined for a multi-product firm. This is because, for a multi-product firm, there is no unique 'quantity of output' that can be divided into total costs. For example, suppose a shop sells 100 cups of coffee and 50 newspapers and that its total costs are $1000. To calculate average total cost it is necessary to divide total cost by a quantity. But should the quantity be just the

number of cups of coffee, just the number of newspapers, or some 'combination' of the coffee and the newspapers? If a 'combination' of cups of coffee and newspapers are used, then how should these different goods be combined? For these reasons, additional cost concepts have been developed by economists in order to deal with multi-product firms; as they commonly are in telecommunications.

For a multi-product firm, total production costs depend on the total amount of each product produced. Broadly speaking, total costs for a multi-product firm may be broken into costs that are specific to an individual product and costs that are not specific for a single product. The latter are called 'common costs.' 'Costs that are not attributable to any particular good or service are called *common costs.* Common costs can be fixed costs but they need not be.'[15] Costs that are product-specific or are attributable to a single product are referred to as the incremental costs of that product. The long run incremental cost (LRIC) of an individual product refers to the product-specific costs associated with the total volume of output of the relevant product. More formally, the LRIC of an individual product is the difference between the total costs incurred by the firm when producing all products, including the individual product under analysis, and the total costs of the firm when the output of the individual product is set equal to zero, holding the output of all other products fixed.[16]

The concept of incremental cost needs to be distinguished from the concept of marginal cost. The marginal cost of product is the increase to total costs faced by a firm when it raises the output of the relevant product by one (and only one) unit. In contrast, the incremental cost of a product refers to the total current output of that product. To avoid confusion between these two concepts the word 'total' is sometimes added to LRIC. Thus, the term 'total service long run incremental cost' is sometimes used to make it clear that the relevant increment in the product under discussion is the total output of that product.[17]

Economists distinguish between a 'long run' and 'short run' on the basis of a firm's ability to unwind its fixed costs.[18] In the short run, certain costs will be fixed in the sense that these costs could not be avoided even if the firm was to cease production. In contrast, the long run is the period of time such that all costs, including those costs that are fixed in the short run, can be treated as variable costs. The use of the term 'long run'

in TSLRIC means that the costs to be included in the analysis of incremental cost include both fixed costs and variable costs related to the relevant product.[19]

The concept of incremental cost also needs to be distinguished from the concept of stand-alone cost. The stand-alone cost of any particular product is the total cost that a firm would incur if that firm produced the relevant volume of the particular product without producing any output of any other product.

A profit-maximising firm would not want to produce a particular product if the revenue it earned from that product fell below the TSLRIC. If the revenue were less than TSLRIC then the firm would be able to increase its profit by ceasing production of the relevant product (in the long run) while holding its output of all other products fixed. If the revenue that a firm earned from a particular product exceeded the stand-alone cost of that product then in theory another firm not currently producing the product would be able to profitably enter production in competition with the existing firm. This is because the revenue associated with the particular product exceeds the costs of just producing that product alone. If the revenue associated with a particular product falls between the TSLRIC and the stand-alone cost of that product then (a) it is profit maximising for the firm to continue producing the relevant product and (b) no other firm would wish to enter into the industry and compete by producing the particular product alone. As a result, it is sometimes claimed that incremental cost forms a relevant price-floor for an individual product or service while stand-alone cost forms a relevant price ceiling for that product or service.[20]

[C] Technology and TSLRIC

TSLRIC is technology-dependent. Because TSLRIC analyses costs, if there are alternative technologies that involve different costs, then the TSLRIC value for a particular product will differ depending on the technology being costed. For regulatory purposes, TSLRIC estimates are usually based on ‘forward-looking’ technology. This refers to the best technology currently available to produce the relevant set of outputs under analysis.

TSLRIC estimates need not be based on forward-looking technology but could be based on actual or historic costs rather than on forward-looking costs.[21] Other cost-based approaches to telecommunications regulation also involve a choice between historic costs and forward-looking costs. There has been significant debate, particularly in the United States, on the use of forward-looking technology when establishing the access prices for various elements in a telecommunications network. When first implementing the 1996 *Telecommunications Act* in the United States, the FCC considered the arguments both for and against the use of forward-looking costs for regulatory purposes and decided to proceed with an approach based on forward-looking costs.[22] This decision has been challenged in the courts and the ability of the FCC to use forward-looking costs for telecommunications regulation was recently upheld by the US Supreme Court (*Verizon Communications Inc v FCC*, May 2002, 219 F.3d. 774).

The use of forward-looking costs to estimate TSLRIC-based interconnection prices and other cost-based pricing in telecommunications has become relatively standard worldwide: 'today most regulators and experts generally agree that the ideal approach for calculating the level of interconnection charges would be one based on forward-looking costs of supplying the relevant facilities and services.'[23]

[C] TSLRIC and common costs

As noted above, TSLRIC might be viewed as a relevant lower bound on the revenue earned by a multi-product firm from a particular product. However, if a firm only received revenue equal to TSLRIC for all of its products then, in general, it would make an economic loss. This is because TSLRIC only considers product-specific costs but makes no allowance for common costs associated with multiple products. A firm that only received revenue equal to TSLRIC on all its products would make a loss equal to its common costs.

For this reason, when TSLRIC is used for regulatory purposes, it is usual to allocate some of the common costs associated with a regulated product to the revenue that can be earned from that product. For example, Intven[24] notes that 'TSLRIC measures the difference in cost between producing a service and not producing it. TSLRIC is LRIC

in which the increment is the total service. Hence, mark-ups are required to recoup a portion of joint and common costs, which are not included in TSLRIC.'[25]

The cost measure that includes both the TSLRIC of a service and an allocation of relevant common costs has been referred to by the ACCC as TSLRIC+.[26] We adopt this terminology here.

Two points need to be noted with regards to increasing TSLRIC cost values to allow for common costs. First, economic principles state that fixed costs (including common fixed costs) should be allocated in a way that creates the least distortion to prices for the relevant product. In general, fixed costs should be recovered from fixed charges. More formally, the economically efficient recovery of fixed costs depends on the responsiveness of demand for the relevant product. If demand for a relevant product is relatively unresponsive then allocating more of the common fixed costs to that product will have little effect on the quantity of that product purchased and will lead to little economic distortion. In contrast, if demand for a relevant product is highly responsive to changes in price then an increase in the allocation of common fixed costs to that product, which leads to a rise in the product price, will lead to a large change in the quantity of the product consumed and a large economic distortion. The use of information about demand responsiveness (both own and cross price elasticities of demand) is a key element in efficiently allocating common costs.[27] Such demand-based allocation of common fixed costs is commonly known as Ramsey pricing.

Second, care must be taken when determining true common costs of production from product-specific costs that relate to facilities or production processes that are used to produce more than one product. For example, suppose that a particular telecommunications product involves the use of a switch that is also used to produce a range of other telecommunications products. Further, if the relevant product was not produced at all, then a smaller (and less costly) switch could be used to provide the other products. Then, the increase in the cost of the switch that is required when the relevant product is produced is a cost that is specific to the product and is included in TSLRIC.

[B] Total element long run incremental cost

While approaches to regulatory telecommunications pricing used in North America and Europe are all based on notions of incremental cost, different countries use different approaches and the differences between these approaches have important practical implications. Intven notes that:

[quote] [t]he European Commission has adopted a TSLRIC-type approach, called, Long Run Average Incremental Cost (LRAIC) as its preferred costing methodology. The term 'average' is intended to capture the policy decision that defines the increment as the total service. LRAIC, hence, includes the fixed costs specific to the service concerned: 'service-specific fixed costs'.[28] **[end quote]**

[NP] In contrast, the United States uses TELRIC. The term TELRIC was first used by the FCC when interpreting its role under the US 1996 *Telecommunications Act*. This Act was predicated on a high degree of unbundling by the Incumbent Local Exchange Carriers (ILECs). Thus, the Act was based on the idea that ILECs would lease elements of the local telephone network to potential competitors. These competitors would then combine these elements together (possibly with their own elements) to provide relevant services for end users.[29]

In order to facilitate element-by-element unbundling of the local telecommunications network, the FCC modified TSLRIC to apply it to each individual element in the local telephone network rather than applying it to services that flow across the network. In other words, the starting point for the FCC in applying the 1996 *Telecommunications Act* was to consider an element-by-element break-down of the network and then to price individual elements on the basis of the cost of the individual element and the traffic flow across that element.

[quote] TELRIC is the incremental or additional cost a firm incurs in the long run to provide a network *element*, assuming all of its other production activities remain unchanged. … TELRIC prices discrete network elements or facilities like the local loop and switching … .[30] **[end quote]**

[NP] The application of TELRIC in the United States has been controversial and, as already noted, has led to a number of disputes before the courts. When referring to the recent decision in *Verizon v FCC,* Kaserman and Mayo note that '[t]he Supreme Court Opinion unequivocally provides authority to the FCC to implement TELRIC pricing for unbundled network elements'.[31] But they also note the ambiguity in determining what is and what is not an 'element' under the 1996 *Telecommunications Act*. For example, 'access to the local exchange network when the transmission involves a long distance call … may not be an "element" under the Act' even though local call termination service is an 'element'.[32]

[B] Does TELRIC differ from TSLRIC?

Some industry commentators have suggested that there is little if any difference between TELRIC and TSLRIC when setting interconnection prices. For example, the Productivity Commission argues that the distinction between TELRIC and TSLRIC is 'somewhat arbitrary'.[33]

The FCC, when devising TELRIC, clearly saw it as a distinct approach to TSLRIC, albeit based on the same underlying ideas when applied to network elements. The FCC also noted TELRIC values will tend to differ from TSLRIC values. For example the element-by-element approach of TELRIC means that there are few common costs.[34] This avoids many of the cost-allocation issues associated with TSLRIC+.

The differences between TELRIC and TSLRIC fall into two categories — practical differences and theoretical differences. The practical differences arise because TELRIC based models (such as the ACCC's NERA model and Telstra's PIE model[35]) cannot calculate TSLRIC because they do not include all relevant services. In other words, their element-by-element approach almost always fails to include the full range of services necessary for a TSLRIC analysis and effectively creates a stand-alone cost model.

The main theoretical difference between TELRIC and TSLRIC relates to the treatment of common costs. TSLRIC+ and the TELRIC differ in the way that they treat any network element that is partially a common cost between two or more services and

partially an incremental cost to one of those services. Because TELRIC simply averages the cost of a network element over the relevant services, it does not allocate any incremental component of the element to the relevant underlying services. In contrast, TELRIC isolates any incremental costs and associates them with the relevant underlying services before allocating common costs.

It could be argued that such differences are likely to be small in practice. After all, so long as the relevant cost 'breakdowns' for individual elements and the relative traffic flows are not 'too different' then any gap between TELRIC and TSLRIC+ is likely to be small. But this is an empirical issue that remains unresolved as of the writing of this chapter.

The theoretical differences between TELRIC and TSLRIC+ pricing arise for a very simple reason. TELRIC is designed to apply on an element-by-element basis over telecommunications networks. It is not designed to apply on a service-by-service basis. In contrast, TSLRIC+ is a service-based measure of costs and is designed to determine the cost basis for regulated service pricing.

[B] Retail-minus pricing and the Efficient Component Pricing Rule

While variants of TSLRIC and TELRIC are the most common approach to regulated interconnection pricing, other approaches have also been used. For example, in some situations, pricing at marginal cost may be appropriate. We consider this further when discussing mobile termination charging in **[cross-reference]** 'Fixed-to-mobile termination' below. **[end cross-reference]**

A controversial approach to interconnection pricing is the Efficient Component Pricing Rule (ECPR). This is a regulatory rule designed to promote productive efficiency among access seekers when there is a vertically integrated access provider. It involves a two-part regulatory process. First, final product prices are restrained by a price cap. Given this cap, the facility owner can sell access at a price that not only recoups his production costs, but also compensates him for any foregone profits from final product sales due to the additional competition from access seekers. ECPR has been strongly advocated by Baumol and Sidak for electricity and local telephone access in the United

States.[36] It was a central issue in an interconnection dispute between Clear Communications and Telecom New Zealand in the early 1990s.

The logic behind ECPR is both simple and, in the correct context, compelling. As an example, consider that the marginal cost of access is $3 per unit of the final good and the other marginal costs of providing a unit of the final good are $5. Let the price of the final good be constrained by a price cap at $10. A facility owner who is vertically integrated and operates as a final market monopolist would make variable profits of $2 per unit from final goods sales. Assume that if the facility owner provides a unit of access to a competitor in the final market then the access provider's sales in this market decline by one for each extra unit sold by the competition. If the facility owner provides one unit of access to a competitor who uses this access to provide one unit of the final good, then the opportunity cost of providing this access is the marginal cost $3 plus the foregone profits $2. Under ECPR the access charge should be set, not at **[XX spell out first reference to SRMC – double check 'short run marginal cost' XX]** (SRMC) which is $3 but at opportunity cost which is $5.

Why is such pricing desirable? Consider a downstream competitor that is not as efficient as the incumbent integrated facility owner. For example, the competitor's cost of producing the downstream product given a unit of access might be $5.50. It would then be economically undesirable for the competitor to enter the downstream market as such entry would result in inefficient production. However, the inefficient competitor could enter if access was priced at SRMC. If the competitor paid $3 for a unit of access and paid an additional $5.50 to produce the final product given the unit of access, then its total cost per unit will be $8.50 - $0.50 more than the cost for the incumbent firm but less than the market price of $10. The inefficient competitor is thus able to enter the retail market and make $1.50 profit per unit. In contrast, if access prices were set by ECPR then the total cost of production for the inefficient competitor would be $10.50 - $5 for a unit of access and $5.50 to turn this unit into final product. The competitor could not make a profit at a final market price of $10. Only if the competitor's costs of turning access into final product were at least as low as those of the incumbent facility owner, would the competitor be able to profitably enter when access is priced according to ECPR.

ECPR can promote efficient entry and production in the final goods market.[37] However, this is not the same as efficient production of the access service. By focusing on efficient production by access seekers, ECPR simply duplicates a function of competition. If we are seeking to open final market production to competition by requiring the facility owner to provide access, then so long as all competitors (including the facility owner himself) can buy access at the same price then competition should drive inefficient downstream producers out of the market. If an access seeker is inefficient then an alternative producer should be able to enter the final market, buy access and force out the inefficient producer. If the access provider himself is inefficient in downstream production then he will also be forced out of final market production and will have to retreat to simply providing access to his essential infrastructure services. Put simply, ECPR only does what we expect competition to do anyway.

In telecommunications, ECPR is most useful when there are either regulated final product prices involve cross-subsidies or when the regulator wishes to establish strong incentives for access seekers to invest in their own facilities. On the former, suppose for example, that the vertically integrated incumbent producer is required to cross-subsidise rural consumers by charging a higher price to urban consumers. If the downstream market is opened to competition with access sold at SRMC, then new entrants will only sell to profitable market segments. New entrants will be able to undercut the incumbent in the urban market as they do not need to cross-subsidise rural consumers. To protect the incumbent and maintain the cross-subsidy, access can be priced by ECPR so that new competitors in the urban market compensate the incumbent for any foregone profits through the access price. Of course, an economist might argue that a better regulatory solution involves either removing the cross-subsidies from the final product prices or removing the facility owner's burden to finance these subsidies. But political realities might prevent either of these solutions, making ECPR interconnection pricing desirable.

Alternatively, suppose that the regulator viewed one-way interconnection as a temporary phenomenon in telecommunications to be maintained only until new entrants can roll out their networks. In this situation, ECPR provides strong incentives for the development of new networks and the evolution of facilities-based competition. In these circumstances, ECPR may provide a useful transition measure for access pricing.[38]

If ECPR is used without final market price caps then the rule is the same as allowing unconstrained monopoly pricing of access. This has been recognised by the proponents of ECPR.[39] However, the problem is not the access pricing rule but rather that ECPR is really a two-stage process. It is only designed to work with final market price controls in place.

In Australia, ECPR pricing has been referred to as retail-minus pricing. The ACCC has used retail-minus pricing for Telstra's declared local carriage (local call resale) service. Telstra faces an explicit price cap on local calls and also faces constraints that require it to set the same price for a local call Australia-wide. In such circumstances, an ECPR or retail-minus approach is sensible and protects Telstra from having its local call service undermined by opportunistic firms who 'cream skim' high value urban customers. In respect of this service, the 'transitional measure' approach referred to above is evident in the ACCC's approach to supply of this service in CBD areas where access providers are now exempt from the regulated supply obligations of the service (on an ECPR basis), primarily in order to promote competitive facilities-based investment in the underlying local network infrastructure used to provide the service. However, in respect of other geographical areas, where the ACCC considers facilities-based competition at the CAN level (see below) to be unlikely to occur to any significant degree for the foreseeable future, supply obligations remain in place. [***xref*** to Part XIC chapter]

[B] Summary

In this section we have reviewed the main approaches to interconnection pricing for telecommunications used in Australia and overseas. While our discussion is not exhaustive, it shows that there is no 'one size fits all' solution to interconnection pricing. Rather, appropriate interconnection prices depend on the exact aim of the access regime and its structure. For example, service-based and element-based interconnection prices lead to different outcomes and are appropriate in different situations.

[A] Allocation of CAN costs

In Australia, TSLRIC and TELRIC modelling has been applied to the inter-exchange transport of calls. Thus, it has been used to determine interconnection charges for the PSTN excluding the CAN. The CAN covers the cable and maintenance of lines from the local exchange to households and businesses. CAN costs are largely sunk and CAN services — namely, basic access charges — are paid by households directly.

Telstra has long argued that CAN costs ought to be at least partly recovered through PSTN interconnection pricing. Basic access charges are subject to price cap regulation and Telstra argues that the capped charges are to cover the CAN costs. The shortfall has been referred to as the access deficit. Telstra argues that the existence of the access deficit necessitates an access deficit contribution (or ADC) built into all PSTN interconnection charges.[40]

The ACCC, in the past, has supported the inclusion of an ADC in PSTN interconnection pricing. However, as Telstra settled its 2002 PSTN arbitration hearing before it reached the Australian Competition Tribunal, this notion has not yet been subject to legal scrutiny. In 2003, the ACCC announced an inquiry into the need for an ADC[41] and in June 2003 it released draft PSTN interconnection pricing guidelines that argue that the case for the ADC can no longer be sustained and that it will be phased out within three years.[42]

In this section we review the ADC concept and evaluate the main arguments put forward in support of it. We argue the economic analysis tends to support the recent ACCC view.

[B] What is the 'access deficit'?

In its 1999 and 2000 Undertaking Reports, the ACCC defined the 'access deficit' as the shortfall between the cost of providing retail basic access and the revenues that Telstra is able to secure under the price control regulations. Telstra's basic access service (the 'standard telephone service', charged to retail customers as line rental) is associated with a customer being able to make and receive calls over the CAN.

The ACCC[43] stated a formulaic definition of the access deficit:

AD = Annual Line Costs + Retail Costs – USO funding – Connection Revenues – Line Rental Revenue

[B] Related telecommunications policies

When calculating the access deficit, regard must be had to two other telecommunications policies — universal service obligation (USO) funding and retail price controls.

[bullet point] *USO Funding:* The USO is the obligation placed on universal service providers (USPs) to ensure that standard telephone services, payphones and prescribed carriage services are reasonably accessible to all people in Australia on an equitable basis, wherever they reside or carry on business.[44] Telstra, currently the sole USP, is subsidised for providing this obligation. The subsidy is funded by all licensed telecommunications carriers in the telecommunications industry.[45] The USO scheme is discussed further in Chapter 7.

[bullet point continue NP] Note that in the definition of the access deficit, it is recognised that for some customers, the access deficit is covered by USO funding received by Telstra. Hence this is treated as revenue offsetting the difference between line rental and CAN costs. **[end bullet point]**

[bullet point] *Retail price controls*: The line rental revenue component is the maximum line rental revenue Telstra can secure under the retail price controls. Telstra may not actually charge the maximum line rental to all of its customers, however, the idea of the access deficit is that it is a shortfall caused by retail price controls. The Telstra price controls regime is discussed further in Chapter 7. **[end bullet point]**

The existence and nature of retail price control policies and USO funding impact upon the size and rationale for an access deficit.[46]

[B] The access deficit as an economic construct

From an economic perspective, it is far from clear that the access deficit has any useful meaning. To see this, note that the services provided by the CAN are used as inputs for other telecommunications services. Few if any customers value basic access in its own right. Rather, customers value basic access because it enables them to consume a variety of telecommunications products, like local and long distance calls, that have the services provided by the CAN as one input. In this sense, the services provided by the CAN are not stand-alone products but rather they are services that, when combined with other services, create valuable telecommunications products.

The approach to the access deficit adopted by the ACCC treats basic access as a stand-alone product and asks whether the direct revenues from that product cover its costs. If the stand-alone product revenues do not exceed the cost then there is a deficit. However, this calculation has no meaning from an economic perspective. It is irrelevant whether there is a surplus or a deficit in terms of direct contributions for one input that is used in combination with other inputs to produce final services.

To see this, suppose that two inputs *x* and *y* are combined with each other to form a final product *z*. One unit of final product *z* requires a consumer to purchase exactly one unit of *x* and then to purchase one unit of *y*. The consumer then puts these two components together to form a unit of z. Further, the consumer can only form a working unit of z if they purchase the unit of *y* from the same manufacturer as the unit of *x*. For example, *x* might represent a razor-handle, *y* might represent a blade, and *z* might represent a finished razor. The consumer must purchase the razor handle and then purchase the blade that 'fits' that handle. The manufacturer might help facilitate this dual purchase by bundling the blade with the razor handle. Assume that consumers only desire the final product *z*. Having a unit of *x* by itself provides no benefit to a consumer. Similarly, having a unit of *y* by itself provides no benefit to a consumer. Also assume that consumers only care what they pay in total for the final product *z*.

Suppose that it costs $1 to produce a unit of *x* and $1 to produce a unit of *y*. If *z* is sold at a competitive price then it will sell for $2. But the seller might 'break down' the $2 price of a unit of *z* in numerous ways. For example, the seller might sell product *x* for $1.40 and product *y* for $0.60. From the consumers' perspective they pay $2 for the final product *z*. However, if the seller did this, then there would be a 'product *y* deficit' of

$0.40 per unit — the 'revenues' for *y* are only $0.60 per unit while the cost is $1 per unit. Alternatively, the seller could hold the price of *z* fixed at $2 but set a price of *x* of $1.20 and a price of *y* of $0.80. If the seller did this, then the 'product *y* deficit' would be $0.20 per unit. In fact, by altering the way they break-down the $2 price of the final product, the seller could create a 'product *y* deficit' anywhere between $1 per unit and -$1 per unit. However, none of these deficit figures would have any economic meaning. They would not alter consumers' final product demand, the total sales of the final product or the profits that are generated in total from the final product.

The economic irrelevance of a 'deficit' that relates to one input of a final product for a single producer is even more obvious if the producer bundles the products. Suppose the producer bundled one unit of *x* together with one unit of *y* and sold this bundle as one unit of *z* to customers. Again suppose that the producer sets the competitive price of $2 for the bundle. Then the producer could immediately create any 'product *y* deficit' between $1 and -$1 that they like by 'breaking down' the $2 price of the bundle between the two inputs. For example, if the producer stated that of the $2 consumer price, $1.35 was a payment for *x* and $0.65 was a payment for *y*, then the producer would create a 'product *y* deficit' of $0.35 per unit. Again, this figure is meaningless as it does not affect the price that consumers pay for the bundle and it does not affect the sales or cost of production for the bundle. From an economic perspective the 'deficit' is an artificial figure.

There is no reason in economics why the provider of a product that involves a number of inputs needs to receive revenues on each individual input that exactly offset that input's cost. For example, mobile phone companies regularly 'sell' mobile phones below cost. However, this does not reflect irrationality on the part of the sellers. Rather, the sellers expect to make up any 'phone deficit' through call charges and customer access revenues. The sellers care about total profit, not the revenues and costs associated with each individual input. Further, there is nothing 'anti-competitive' about such pricing. Such pricing could arise even in highly competitive markets and often reflects a benefit to customers. For example, in mobile phones, new mobile phone users might be reluctant to pay a large sum for a phone when they are unsure of how much they will use that phone. By selling the phone at a low price that is below cost the mobile phone company takes the

risk away from the customer. If the customer finds that they do not use the mobile phone very much, then they pay little. Conversely, if the customer finds the mobile phone useful, then they pay for the phone through the call charges. By taking the risk away from the customers, more customers will use mobile phone companies that set low phone prices and these companies will be more profitable.

From an economic perspective, the correct way to view the CAN is as one of the common fixed costs necessary to provide a variety of telecommunications products, including PSTN access. To evaluate any deficit created for Telstra due to price constraints on the CAN, it is necessary to consider all of Telstra's costs and revenues from providing services that involve customer access. If providing access to a customer is profitable to Telstra, when all revenues and costs associated with that customer are considered, then in our view there is no meaningful 'access deficit' for that customer.

[B] Arguments for an access deficit contribution

Suppose, however, that there is an 'access deficit' in the sense that Telstra's line rental and connection charges do not cover the stand-alone costs of providing the CAN. If there is an access deficit, should Telstra receive a contribution from access seekers to the PSTN for this deficit? Two distinct arguments have been put forward to support the ADC. In the past, the ACCC emphasised issues of investment incentives if an access deficit contribution is not made:

[quote] … to the extent that legislation restricts Telstra's ability to raise line charges to cost, then preventing Telstra from seeking a contribution from charges for call services would lead to under-recovery of fixed line costs, thereby discouraging efficient levels of infrastructure of investment.[47] **[end quote]**

[FO] It has also been argued that failure to have an ADC will lead to an under-pricing of access to Telstra's PSTN and hence, excessive entry and 'cream skimming' by entrants in related downstream markets.

[C] The investment incentives argument

At a fundamental level, any losses Telstra makes on basic access as a stand-alone business represent a fixed cost of being a ubiquitous provider of telecommunications services. As we noted above, it is the existence of related services that make basic access valuable and it is the extent to which profits can be earned on those other services that allows an access deficit to be financed. The access deficit is a fixed cost that is recovered from the profits of other related activities.

This is the essence of the investment incentives argument. Suppose that entrants did not have to bear any part of the fixed costs associated with providing basic access. Then it is possible that such entrants could compete away all of Telstra's business where it was generating profits to pay for the fixed costs of basic access. In this dire scenario, Telstra would go bankrupt and would certainly have no incentive to maintain and renew infrastructure for providing basic access. In the Australian context, this simple argument is incomplete because Telstra receives a payment from the government for losses in providing basic access. The *universal service obligation* and its associated industry fund is designed to cover situations where Telstra has a customer (or an exchange area) on which it makes an overall loss. Therefore, under the dire competitive scenario, where Telstra is left with no profits on related services, Telstra's access deficit would be precisely covered.

As such, the existence of the USO rules out the dire scenario of Telstra being made bankrupt and indeed any real possibility of entry causing serious losses for Telstra. The USO fund guarantees that if Telstra were to only be a provider of basic access, it would earn a market return on that service.

The existence of the USO fund means that Telstra's fixed costs associated with providing access will always be covered. What, however, does this mean for its incentives to invest in the CAN? Recall, that it has been argued that Telstra would have little if any incentive to invest in the CAN if it did not receive an access deficit contribution. However, Telstra's universal service obligations require such investments and compensate Telstra for them through the USO fund. Indeed, as that fund is cost-based, if anything it may provide too much rather than too little incentive to maintain and

expand the CAN. This is because Telstra is effectively reimbursed for such expenses; subject, of course, to its use of best available technologies.

Recent federal government policy further undermines any notion that the ADC is required to provide investment incentives. The government has announced that the price cap on basic access will be raised to remove the access deficit over the current decade.[48] As CAN investments are generally long term, it is unlikely that these investments will be effected by the short-term presence or absence of an ADC.

[C] The cream skimming argument

The second argument used to justify an ADC is based on cream skimming. This argument suggests that if no ADC is allowed then entrants will face more favourable conditions than the access provider in related service markets. If this is the case, then it is possible that entry could occur even when an entrant has higher production costs or lower product quality than the access provider in those related service markets.

This argument rests on an assumed inability of Telstra to respond to inefficient entry by lowering its own prices. However, there is no reason why such an assumption needs to hold true, particularly given the existence of the USO fund. The existence of this fund means that Telstra is not hindered in its response to any inefficient entry.

[B] Summary

In our opinion, the underlying economic structure of the ADC is badly defined while the purported arguments in favour of an ADC are weak. If there is an effective USO contribution scheme operating then there should be little if any concern about an ADC. Further, if there was an economic concern about a so-called access deficit then this suggests that the USO contribution mechanism needs to be revised, not that an ADC should be added to PSTN interconnection charges. Finally, if there was a legitimate requirement for Telstra or any other carrier providing universal service to recover an access deficit other than through a USO fund, then this deficit should be funded from all

relevant products using Ramsey pricing principles. It should not simply be recovered from a subset of services that use the PSTN.

[A] Fixed-to-mobile termination[49]

PSTN interconnection charges involve calls made between fixed line customers or from mobile to fixed line phones. But interconnection (termination) charges are also levied by mobile phone operators for fixed-to-mobile calls. In this section, we consider the issues surrounding the termination of fixed-to-mobile calls and show how the economics of mobile termination differs from PSTN interconnection. In so doing we reinforce the underlying message — that interconnection in telecommunications does not involve a simple one-size-fits-all pricing approach. We also introduce some of the economic issues that arise in two-way interconnection.

[B] Background

Mobile termination services were declared in 1997. Originally, only GSM services were covered by the declaration but the definition of termination services was broadened in March 2002 to include CDMA.[50] The ACCC has opted for a light handed approach to the regulation of mobile termination charges (its pricing guidelines were released in July 2001). For fixed-to-mobile termination charges, the ACCC currently uses a 'retail benchmarking approach'.

[quote] … changes in each mobile carrier's access prices are benchmarked against the retail price movements of its overall mobile package (including access and outgoing calls). The initial starting point for the glide path created by this pricing rule is the lowest current access prices for the mobile origination and termination services in the market.[51] **[end quote]**

[FO] More recently, however, the ACCC has embarked upon a review of existing arrangements. At the time of writing this chapter, that review was yet to be completed.

[B] Assessing market power in mobile telephony

Is there a regulatory problem in mobile termination? At first glance it might appear that there is no problem. After all, there are many providers of mobile carriage services who actively compete for customers. However, the intensity of competition for mobile subscribers can mask less-obvious sources of market power. As we noted in our earlier work,[52] competition does not constrain the pricing of mobile termination services in the same way that it constrains retail mobile service pricing. This is because of: [therese please bullet] (1) the way customers utilising mobile termination services perceive their competitive options; and (2) the nature of the interconnection behaviour of mobile carriers.

[C] Access to a customer and customer ignorance

Telecommunications involves a two-way network, where the party that makes and pays for the call is not always the same as the party that chooses the company that supplies the call. This is the situation under mobile termination where the calling party(A-party) pays the price of the call, but the receiving party (B-party) chooses the terminating carrier. Because of this asymmetry between the party paying for the call and the party who chooses the provider of terminating services, telecommunications companies tend to have some degree of market power when terminating calls. Once a person has decided to join a specific mobile network, that network has a degree of monopoly power over the price that it charges any other party wishing to call that specific person.

This market power may be trivial or non-existent in certain circumstances. For example, if a person choosing a mobile network cares as much about the price of incoming calls as they do for outgoing calls, then any attempt by a mobile network to raise its termination charges may lead such a person to change networks. This is likely to be approximately true where the mobile phone is to be used almost exclusively within a

well defined calling group, such as a single family or a single company. For example, suppose that a mobile service is to be used by one employee of a company exclusively to make and receive calls from other members of that same company. Then when the manager of the company chooses a mobile carrier, he or she will base that decision on the cost of both making calls from that mobile service and receiving calls to that mobile service. Any attempt by the mobile carrier to raise termination charges and consequently the price of calling that mobile phone will be perceived as an increase in cost to the company who will then seek to purchase mobile telephone services from a cheaper carrier. Similarly, if members of a household mainly use their mobile phones to contact each other (possibly from a fixed line telephone) the person choosing the mobile carrier will care about the costs of making calls both to and from the relevant mobile telephone.

In general, however, it seems reasonable to assume that many parties choosing a mobile network attach a greater weight to the outgoing call charges that they pay directly than to the incoming call charges for which they, at best, are indirectly liable.

The market power generated by the control of call termination might be relatively small except for a second characteristic of many telecommunications systems, including the current Australian mobile telephone system. Specifically, it makes little or no difference to people who are calling a mobile telephone from a fixed line telephone what carrier the receiving party is on. This is because their pre-selected long distance operator does not distinguish between different mobile carriers in their fixed-to-mobile call rates.[53]

There are several reasons why this lack of price differentials might arise. First, there may be a constraint in the billing system or a desire of the fixed line operator to keep its pricing structure simple. Second, and more importantly, there may be customer ignorance regarding the network a call is being made to. That is, a person who calls a mobile phone user will often have little idea as to the exact mobile company that will terminate their call. In particular, unless the A-party remembers which mobile phone companies happen to have which four digit prefixes — although with mobile number portability even this information is not particularly useful — the A-party can only guess the exact mobile company that will terminate their call. For many calls to mobile networks (especially those from fixed lines) it seems reasonable to assume that the A-party has no information beyond the market shares of the mobile carriers or the

probability that they might be calling one or other network. So even if mobile carriers offered different termination rates and these were passed on in terms of differential pricing to consumers, customers will not know the precise cost of their calls to mobile telephones in advance but can only use an estimated price based on market shares.[54]

To see the effect of this uncertainty, suppose that the opposite were true and a customer making a fixed-to-mobile call both knew the identity of the terminating carrier and the price of the call. In some circumstances, the mobile network will retain some market power. If the A-party has to contact a specific person then they will still make the call, although if the per minute termination charge is high, they might truncate the call or ask the person on the mobile phone to call them back. In other cases, the mobile carrier will have little market power. If the A-party does not need to call a specific person, but rather can choose any individual from a group of people, then they will choose the individual who is cheapest to contact. For example, if the A-party needs to call a plumber, but has no preference over which plumber they contact, then they will choose the plumber that is linked to the mobile network with the lowest priced calls. This will, in turn, make the plumber indirectly face the termination costs — if they join a mobile network with high termination charges then this will tend to lead to higher priced calls for this mobile network and the plumber will receive fewer calls and less business. A mobile network with higher termination charges will have fewer members and competition will tend to moderate termination charges.

In contrast, suppose that the person making the fixed-to-mobile call is only able to guess at the identity of the terminating network. In particular, suppose that the A-party only knows the market shares of mobile carriers and that there is a price differential between calls to respective networks. Then the caller only responds to average call prices implying that each mobile network does not bear the full competitive consequences from raising their termination charges and, consequently, will have considerable discretion to raise these charges. When one network raises its termination charges, this raises the average price that the A-party pays. But the A-party only knows this average and because they cannot distinguish between mobile networks, they will make their calling decisions on the basis of this average, not the network specific charges. This, in turn, breaks the

indirect link between termination charges and call frequency to a specific mobile customer.

This effect, where a customer calling a mobile number cannot *ex ante* identify exactly which mobile network is associated with a particular mobile number, and so cannot identify the network that they are 'buying from', is referred to as *customer ignorance*. Its implications are profound: even if fixed line networks passed through termination rates to fixed line customers, differential termination rates cannot be used as a locus of competition. In the end, customer ignorance will tend to drive the use of uniform charges for calls to mobiles as a differential charge will be of limited use to a consumer in choosing which network to make calls to.

To see this, note that if a mobile carrier raises its termination charges under customer ignorance, this affects the average price that a customer pays for calling any mobile network. But it does not affect specific calls to any one mobile carrier relative to any other carrier because the customer cannot identify the carrier that they are calling. Thus, if one carrier raises its termination charges, and this raises the average fixed-to-mobile price, then customers may make fewer and shorter calls. But they will make this adjustment for *all* calls to mobile telephones as they cannot identify the specific carrier that they are calling. The network that raises its termination charges does not bear the full customer reaction from this price rise, but shares this reaction with the other mobile networks. In economic terms, there is a 'negative externality' between mobile networks, as each network is likely to receive fewer and shorter fixed-to-mobile calls when another mobile network raises its termination charges. Basic economics shows how there will tend to be 'overproduction' of negative externalities. In this situation, the negative externality is associated with an increase in termination charges, so we would expect to observe excessive mobile termination charges for otherwise competing mobile telephone networks.

In summary, mobile termination charges create a potential problem of market power due to (a) the caller pays principle under which the party paying for a call to a particular mobile carrier is not the party that chooses that mobile carrier; and (b) the problem of customer ignorance, whereby a party calling a mobile phone is likely to have little idea of the exact identity of the mobile carrier and the price of the call, beyond

average market shares and call prices. These sources of market power create incentives for otherwise competitive mobile carriers to raise termination rates above the true cost of termination services.

[B] Regulation and mobile termination charging

Given the issues of market power, the best response to the problems of termination may not be price regulation but structural change. Elsewhere[55] we propose two structural changes that would obviate the need for price regulation.

The first of these involves a technological change that allows mobile carriers to be identified to callers from fixed line firms. *Carrier identification* would mean that when a call was made to a mobile, a chime or other signal would be made to indicate to the caller the network being called. The caller might then, with knowledge of any differences in fixed-to-mobile call prices between carriers, have an opportunity to change their behaviour. This change would allow a competitive response to be effective in mobile termination.

The key problem of mobile termination is related to the clarity of information available to customers, the tendency to average prices over mobile carriers and the tendency for double marginalisation. One way to assist customers in gaining information about mobile call prices and to assist regulators in analysing the behaviour of both fixed and mobile carriers is to have mobile carriers directly set the price of termination for fixed-to-mobile callers. That is, calls to mobiles on the fixed line bill would each be shown as two line items rather than a single line item; a mobile terminating charge and a trunk-originating charge. The actual billing would still be done by the fixed carrier (in return for a regulated billing fee) and calls would still be paid for by the caller. However, the mobile network would directly — rather than indirectly — determine the termination charge paid by the customer.

Nonetheless, neither carrier identification nor direct termination charging appear likely to be implemented in Australia in the foreseeable future. Instead, price regulation of mobile termination may be strengthened. Here we review alternative proposals for price regulation.

[C] The consequences of reducing mobile termination charges

Given the interdependencies identified earlier, a reduction in mobile termination charges for calls from fixed networks would impact on other prices. In particular, *simple regulation of termination charges and prices downward will raise mobile subscription rates*.

When termination charges are high, this means that mobile networks receive additional termination profits from attracting another customer. Such termination profits offset any costs associated with attracting a customer. Consequently, when those profits are high, this makes mobile carriers more likely to set low retail prices to attract customers with any sacrifice in subscription revenues being made up for by additional termination profits. Consequently, if a regulated termination charge were to reduce termination profits, this will soften competition for mobile subscribers and lower mobile network competition. This is because the lower termination charges mean that servicing marginal customers becomes effectively more costly for mobile networks and hence, their incentive to offer lower subscription rates is diminished. Thus, we expect that regulation of termination charges will lead to higher mobile subscription rates in the long-term than would arise in the absence of such regulation. Nonetheless, this will still be socially desirable as deadweight losses on the fixed-to-mobile service are reduced.

[C] ACCC's current approach

The ACCC currently employs what it calls a 'retail benchmarking approach.' This approach benchmarks a carrier's mobile termination charges to retail price movements across all of its mobile services (including termination and out-going call prices). The starting point is to take the lowest current termination charge amongst mobile carriers. The ACCC believed that this would promote competitive outcomes although it qualified this, recognising that rises in mobile service charges would lead to upward movements in termination charges over time.

The main problem with this approach is that, by linking mobile termination charges and retail prices for mobile services, the ACCC changes the competitive interaction between mobile carriers. Previously, mobile carriers had strong incentives to reduce retail mobile prices to attract customers and gain the terminating revenues associated with that customers. A set regulated price for termination services would reduce this form of competition. Because termination charges are limited, subscriber competition will be reduced.

But an interlinked termination charge rule, such as that employed by the ACCC, has an additional effect on reducing competition in retail mobile services. Lowering the price of those retail services to attract new customers means that the mobile carrier will face pressure to reduce its termination charges as well. The competitive price reduction has a double hit on mobile carrier profits — the direct effect through the reduction in retail prices and the indirect effect through reduced termination revenues. The overall effect should be to mute retail mobile competition.

[C] Marginal cost pricing

As we demonstrated in our earlier work[56] and as has been confirmed by subsequent research,[57] economic efficiency (balancing the needs of consumers and carriers) will be achieved by setting mobile termination rates equal to short-run marginal cost.

To see this, consider fixed-to-mobile calls as a stand-alone service with the prices of those calls set equal to the true marginal cost of the service. This marginal cost would include originating and terminating costs as well as trunk costs. That is, suppose that the marginal trunk cost of a call was c_1, the cost of originating a call was c_O and marginal termination cost was c_T, then the total marginal cost of a fixed-to-mobile call would be $c = c_O + c_1 + c_T$. Given the mark-up charged by the fixed line network, in order to have fixed-to-mobile call prices equal the underlying economic cost of these calls, the regulated termination charge, T, would have to be less than c_T; the marginal termination cost.

However, the fixed-to-mobile service is not a stand-alone product. The profits (or losses) earned by mobile networks from this service influence their incentives to compete

for subscribers. The value to a network of an additional subscriber is the sum of the profits it receives from subscription fees and call charges to that subscriber and also the termination profits it receives from calls made to that subscriber. If termination charges are set below cost (that is, $T < c_T$), then an additional subscriber is a liability on the termination side rather than an asset. This means that mobile networks will have diminished incentives to lower subscription rates to attract customers and may even raise them as regulation takes effect. To state this another way, with below-cost termination pricing the costs of competing for mobile customers are increased and competition for mobile subscribers falls.

Thus we have two offsetting considerations. If there is fixed line market power then setting mobile termination charges below marginal cost might help offset the distorting effect of fixed line carrier market power on the price of fixed-to-mobile calls. At the same time, setting mobile termination charges below cost will tend to mute competition for mobile subscribers, potentially creating an economic loss in the mobile services market. Overall, this suggests that the best regulated mobile termination price to balance these offsetting effects is likely to be close to marginal cost.

[C] What about fixed costs and investment?

Marginal cost pricing does not include fixed and common costs. This creates significant problems for one-way access. A firm subject to marginal cost access prices will not generally recover any fixed costs and will operate at a loss. Knowing this, the regulated firm will not invest in new fixed infrastructure as it will receive no return on its investment.

For two-way interconnection, such as for mobile networks, this conclusion is not valid. Reducing mobile termination charges to marginal cost means that mobile carriers will recover their fixed costs from the retail mobile services that they provide to their subscribers. We would expect competition in mobile services to reduce the price of mobile services until they just cover all costs including fixed costs. The mobile carriers will receive a market-based return on their fixed infrastructure investments and

investment incentives will not be muted by the regulation of termination prices to marginal cost.

An obvious example of this effect is where interconnecting networks use a bill-and-keep rule. Under this rule, the price of interconnection is mutually set at zero. There are no payments between networks when calls are transported between the networks. This does not mean that the networks operate at a loss. Rather, it means that they recover the fixed costs of network investment directly from their subscribers.

The basic result, that regulation of termination revenues will have little if any effect on mobile carrier profits and incentives to invest, is strong. It means that, in the absence of any significant empirical or theoretical evidence[58] to the contrary, the correct starting assumption is that termination charges are both investment and entry neutral.

This said, there is a need for significantly more research on the linkages between interconnection pricing and incentives to invest in infrastructure for two-way interconnection. While appropriate regulated pricing rules exist for traditional (or one-way) access issues that can generate socially optimal infrastructure[59] the two-way interconnection issue is fundamentally more difficult; especially given the interaction between competition and horizontal trade between incumbent and entrants.

While setting termination charges at marginal cost does not affect investment incentives, it also implies that none of the mobile carriers' fixed costs are recovered from fixed-to-mobile calls. This need not satisfy the principles of Ramsey pricing. Hausman[60] argues that some portion of the common costs of providing a mobile phone service should be borne by fixed line customers. In its investigations, the UK Competition Commission agreed that some allocation of common costs was warranted. The Competition Commission advocated what it called a LRIC approach to mobile termination charging that included some fixed costs. [61]

While using a Ramsey pricing approach to allocate at least part of the fixed costs of mobile operators to mobile termination charges might be desirable, such an exercise is not costless. Further, any attempt to determine optimal Ramsey prices will be contentious, as it depends on the demands for each mobile service, the interaction between these demands and the effects of mobile competition. It also requires the regulator to determine how much of the charge should be a fixed charge (such as a per

customer charge to fixed line customers), how much should be call based (such as a fixed-to-mobile flag fall charge) and how much should be time based. Overall, there will be considerable argument about the appropriate proportion of fixed costs associated with mobile carriers that should be borne by fixed line customers. However, the main debate that arose was whether fixed line customers should pay a disproportionately high share of these costs — as they currently do given relative fixed-to-mobile as opposed to mobile-to-fixed call rates.

Given the relatively competitive nature of the mobile services market, the limited effects on investment incentives and its regulatory simplicity, setting mobile termination charges equal to marginal cost is likely to provide a sensible and workable second-best solution to the problem of market power in mobile termination.

[B] Summary

Mobile termination charging provides a good example of the different issues that arise in two-way interconnection. As network-based competition develops in Australia, these type of interconnection issues will begin to dominate telecommunications regulation, in contrast to the historic focus on one-way interconnection. And at some point, the two approaches to regulation need to be made consistent. For example, as noted in the introduction, mobile phones are becoming substitutes rather than complements for fixed line services in developed countries.

If mobile and fixed line networks actively compete for subscribers, this does not remove the need for regulation. Termination charges still create a bottleneck particularly under customer ignorance. Termination charges might be used as a device to soften inter-network competition and discriminatory practices involving on-net and off-net pricing may remain a competitive concern. However, viewing mobile and fixed line networks as engaged in network-based competition does suggest that the distinction between mobile termination charging and fixed line termination charging is arbitrary. Rather there should be a reciprocal charging rule for termination. To the degree that call volumes are roughly balanced in mature networks, so that there is no systematic bias in traffic flows between any two networks, reciprocal pricing means that termination charges, on average, become

neither a revenue source nor a cost to carriers. While the exact level of the charges can affect marginal behaviour and can influence the intensity of competition, many of the issues associated with termination charging can be removed by making them symmetric.

This longer-term view of the development of telephony in Australia suggests a simple alternative approach to mobile termination pricing. Mobile termination charges need to be the same as fixed line termination charges so that the charges are reciprocal. This means that the ACCC needs to maintain consistency between the PSTN termination charges set by Telstra for mobile carriers and the fixed-to-mobile termination charges set by the mobile carriers. At present there is a significant gap between these charges. Reciprocal charging would remove this gap.

The correct reciprocal price for network-to-network competition is still a matter of ongoing economic research. For example, there is debate about the desirability or otherwise of a zero termination charge, called bill-and-keep.[62] As such, it would be premature for the ACCC to try and determine an optimal reciprocal price and to aim for that price. The optimal price may be zero as under bill-and-keep or it may be close to a marginal termination cost — say one or two cents per minute. However, the ACCC should be focusing on the future development of telecommunications in Australia and moving regulations towards two-way interconnect arrangements. For example, the ACCC could move the mobile termination rate towards the PSTN termination rate over time. The PSTN termination rate is set for a wide range of services, not just for mobile call termination, and so is influenced by a variety of issues beyond mobile termination. By moving the mobile termination rate down to the PSTN termination charge over time the ACCC can allow for the movement to reciprocal pricing as the mobile industry matures. This avoids sudden price shocks due to rebalancing by mobile operators. It also allows the Commission to gather data to confirm the convergence towards network-on-network competition and to ensure that the underlying assumption of (approximately) balanced call flows both emerges and holds true over the longer term.

[A] Conclusion

In this chapter we have surveyed a variety of economic issues relating to the regulation of interconnection charges in telecommunications. The current approach that dominates telecommunications interconnection both in Australia and internationally is based on LRIC. This approach is based on a one-way notion of access. The key underlying problem is viewed as the natural monopoly nature of the PSTN, and interconnection is similar to essential facility access in other infrastructure industries such as energy and transportation.

The development of incremental cost interconnection pricing in Australia has involved certain idiosyncratic features. In particular, it has been argued that PSTN interconnection charges in Australia should include a contribution for the so-called access deficit. This deficit relates to the CAN and is claimed to arise due to the retail price controls that are placed on Telstra. At the same time the CAN is used as an input into a vast range of telecommunications products including voice and data calls, leased line services and internet services such as ADSL. Telstra also receives a contribution to the CAN costs through the universal service fund. It is far from clear that the concept of an access deficit, as defined by the ACCC has any economic merit. It is also unclear that any so-called access deficit should be recovered by distorting PSTN interconnection prices.

While interconnection policy in telecommunications has traditionally been viewed as a one-way access problem, the development of network-based competition means that two-way interconnection is becoming more relevant. Network competition does not remove the need for some form of regulation of interconnection, but it does substantially alter the nature of the problem faced by the regulator. Solutions, such as marginal cost pricing for mobile termination charging, that are impractical under one-way access are both sensible and desirable under a two-way access problem. In fact, it is not uncommon for competing networks to set an interconnection charge below marginal cost, using a zero charge such as bill-and-keep. As telecommunications develops in Australia and network-based competition becomes more prevalent, both interconnection regulations and the regulators themselves will need to adapt.

[1] See Panzar, J 'Technological determinants of firm and industry structure', in Schmalensee, R & Willig, RD (eds) *Handbook of Industrial Organization*, Vol. 1, North-Holland, Amsterdam, 1989; and Waterson, M 'Recent developments in the theory of natural monopoly', *Journal of Economic Surveys*, 1987, 1: 59–80.

[2] Armstrong, M, Cowan, S & Vickers, J *Regulatory Reform: Economic Analysis and the British Experience*, MIT Press, Cambridge, 1994, pp. 200–202.

[3] Gans, JS, King, SP & Wright, J 'Wireless Communications', in Cave, M, Majumdar, S and Vogelsang, I (eds) *Handbook of Telecommunications Economics*, North-Holland: Amsterdam (forthcoming), 2003.

[4] 'Peering' refers to a reciprocal agreement between interconnected internet networks to carry each others traffic at no charge. See Australian Competition and Consumer Commission 'Internet interconnection service' An ACCC Discussion Paper, April, 2003.

[5] Oftel 'Effective competition review: mobile', A Statement issued by the Director General of Telecommunications, Office of Telecommunications (Oftel), London, 26 September 2001, Annex 1, para. A1.14.

[6] Cadima, N & Pita Barros, P 'The Impact of Mobile Phone Diffusion on the Fixed-Link Network', CEPR Discussion Paper 2598, Centre for Economic Policy Research, London, 24 October 2000.

[7] Rodini, M. Ward, M & Woroch, G 'Going mobile: substitution between fixed and mobile access', Working Paper, University of California, Berkeley, 2002.

[8] Sung, N & Lee, Y-H 'Substitution between mobile and fixed telephones in Korea', *Review of Industrial Organization*, 2002, 20: 367–74.

[9] Laffont, JJ & Tirole, J *Competition in Telecommunications*, MIT Press, Cambridge, MA, 2000. p. 148.

[10] See for example ACCC 'Revised pricing guidelines for access prices of PSTN terminating and originating access services provided by non-dominant or smaller fixed networks: Pricing Principles Paper', January 2002.

[11] A useful reference that summarises much of the literature on multi-product firms up to the end of the 1980s is Panzar.

[12] Gans, JS, King, SP & Mankiw, NG *Principles of Microeconomics* (2nd Pacific Rim Edition), Thomson, Melbourne, 2003, p. 269. Similar definitions can be found in most introductory texts on microeconomics.

[13] Gans, King & Mankiw, p. 270.

[14] Gans, King & Mankiw, p. 272.

[15] Sidak, JG & Spulber, D *Deregulatory takings and the regulatory contract*, CUP, Cambridge, 1997, p.23, emphasis in original. Further, Sidak & Spulber note that: 'A firm's *common* costs are costs incurred in the provision of some or all of the firm's services that are not incremental to any individual service. Hence, common costs can only be avoided by shutting down the entire firm or by not producing a particular group of services under study' (pp. 312–13, emphasis in original). Sidak & Spulber also note that the term 'joint costs' is sometimes used (pp. 312–13).

[16] It is possible to also talk about the incremental cost of a group of products. This refers to the costs of the relevant firm that are specific to either an individual product in the group, a combination of products in the group, or are specific to the group of products as a whole.

[17] 'The term 'total service,' in the context of TSLRIC, indicates that the relevant increment is the entire quantity of the service that a firm produces, rather than just a marginal increment over and above a given level of production. Depending on what services are the subject of a study, TSLRIC may be for a single service or a class of similar services. TSLRIC includes the incremental costs of dedicated facilities and operations that are used by only the service in question. TSLRIC also includes the incremental costs of shared facilities and operations that are used by that service as well as other services."(FCC, *The first report and order re local competition*, Common Carrier Docket 96-98, 1996, para. 677.)

[18] 'The term "long run," in the context of "long run incremental cost," refers to a period long enough so that all of a firm's costs become variable or avoidable' (FCC, *The first report and order re local competition*, para. 677).

[19] The ACCC states that 'TSLRIC is the incremental or additional costs the firm incurs in the long term in providing the service, assuming all of its other production activities remain unchanged. It is the cost the firm would avoid in the long term if it ceased to provide the service' (*Access pricing principles – Telecommunications, a guide*, July 1997, p. 28).

[20] See for example Baumol, W & Sidak, JG *Towards competition in local telephony*, MIT Press, Cambridge, MA, 1994, pp. 66, 77–78.

[21] 'Because the practice is so widespread, it is often implicitly assumed that TSLRIC pricing must always be based on an optimised model of the network, and valued at replacement cost of modern equivalent assets. This is not correct, however. It would, for example, be possible to construct TSLRIC prices for a real rather than a notional network valued at historic rather than replacement cost.' (CRNEC *The estimation of telecommunication service costs using TSLRIC: a draft of a report for the Ministry of Economic development*, University of Auckland, May 2001, para. 7.)

[22] See paragraphs 635 and 639 of FCC, *The first report and order re local competition*.

[23] Intven, H (ed) *Telecommunications Regulation Handbook*, The World Bank, Washington, November 2000, pp. 3–25.

[24] Intven, Appendix B, p. B15.

[25] See also FCC *The first report and order re local competition*, at para. 643.

[26] 'The existence of common (unallocable) costs means that pricing at TSLRIC fails to achieve overall cost recovery. … a practical "solution" to the cost recovery problem has been found by including a contribution to common costs in TSLRIC (sometimes called TSLRIC+), but this involves an efficiency-in-use cost because the higher price means that some units are not supplied even though they have a value in use above their cost of provision to the economy." (ACCC *Submission to the Productivity Commission Telecommunications Competition regulation Inquiry*, 2000, Attachment 3, pp.2–3.

[27] See Laffont & Tirole, particularly section 2.2.1. If the relevant product is a wholesale product such as PSTN access then the elasticity for the product is derived from the elasticity of demand for the retail product(s) produced using that input. As the input price rises this leads to a rise in retail prices and a reduction in consumers' purchases. The elasticity is a measure of this consumer response.

[28] Intven, Appendix B, p. B15.

[29] See Rosston, G & Noll, R 'The economics of the Supreme Court's decision on forward looking costs', *Review of Network Economics*, 2002, 1: 81–89.

[30] Productivity Commission *Telecommunications competition regulation*, Report No.16, AusInfo, Canberra, 20 September 2001, p. 622, note 1, emphasis in original.

[31] Kaserman, D & Mayo, J 'The Supreme Court weighs in on local exchange competition: the meta-message', *Review of Network Economics*, 2002, 1: 119–31, p.123.

[32] Kaserman, D & Mayo, J, pp.123–24.

[33] *Telecommunications competition regulation*, p. 622, note 1.

[34] FCC *The first report and order re local competition*, para. 678.

[35] For example, see Telstra, 'Telstra's submission in relation to the methodology used for deriving prices proposed in its undertakings', 9 January 2003, available at www.accc.gov.au.

[36] See Baumol & Sidak 'Towards competition in local telephony'; and Baumol, W & Sidak, JG 'Stranded costs', *Harvard Journal of Law and Public Policy*, Summer 1995, 837–49. Hyde, C & Negrin, J-L 'Access pricing: a survey', Research paper Number 735, Department of Economics, University of Melbourne, 2000, provide a survey on ECPR.

[37] The example given above is very simple. In any actual market, ECPR needs to be adjusted to retain its desirable features. For example, a unit of a competitor's product need not crowd out exactly a unit of the incumbent's product. See Armstrong, M, Doyle, C & Vickers, J 'The access pricing problem: a synthesis', *Journal of Industrial Economics*, 1996, 44: 131–150. The example also assumes that the final price stays constant at $10, even if inefficient entry occurs. In contrast, if the access price was set at $3 and the threat of inefficient entry forced the incumbent facility owner to reduce his final product price to $8.49 in order to prevent entry, then the threat of (inefficient) entry would not lead to any actual inefficient production but would benefit consumers by lowering the final product price. See also Economides, N & White, L 'Access and interconnection pricing: how efficient is the efficient components pricing rule?', *Antitrust Bulletin*, 1995, 40: 557–79.

[38] See King, S & Maddock, R 'Competition and almost essential facilities: making the right policy choices', *Economic Papers*, 1996, 15: 28–37.

[39] See Baumol and Sidak, 'Towards competition in local telephony', p. 108.

[40] In its most recent, February 2003 PSTN undertaking, Telstra refers to the ADC as the recovery of uncovered PSTN CAN costs (or UPCC).

[41] Australian Competition and Consumer Commission, 'The need for an access deficit for PSTN access services prices', Discussion Paper, February 2003.

[42] Australian Competition and Consumer Commission 'Draft determination for model price terms and conditions of the PSTN, ULLS and LCS services', June 2003.

[43] Australian Competition and Consumer Commission, 'A report on the assessment of Telstra's undertaking for the Domestic PSTN Originating and Terminating Access services', July 2000**.**

[44] See section 9, *Telecommunications (Consumer Protection and Service Standards) Act 1999*.

[45] See further at <http://www.aca.gov.au/consumer/ uso/funding/funding.htm>.

[46] Appendix A of Gans, JS & King, SP 'The Access Deficit Contribution for PSTN Interconnection Pricing', Submission to the ACCC Inquiry on the ADC, February 2003, provides a detailed description of these schemes and considers how they impact upon the logic for an access deficit contribution.

[47] Op. cit. ACCC July 2000 at p. 37.

[48] Minister of Communications, Information Technology and the Arts, 'Government response to Productivity Commission report on the review of telecommunications competition regulation', Mrch 4, 2003.

[49] Parts of this section are drawn and updated from our earlier work in this area: Gans, JS & King, SP 'Termination Charges for Mobile Phone Networks: Competitive Analysis and Regulatory Options', Working Paper, Melbourne Business School, University of Melbourne, 1999 (www.core-research.com.au); Gans, JS & King, SP 'Mobile network competition, customer ignorance and fixed-to-mobile call prices', *Information Economics and Policy*, 2000, 12: 301–27; and Gans, JS 'An evaluation of regulatory pricing options for mobile termination services', mimeo., University of Melbourne, December 1999.

[50] Australian Competition and Consumer Commission, *Mobile Services Review 2003*, An ACCC Discussion Paper, April 2003

[51] Ibid at p. 32.

[52] Gans, JS & King, SP 'Termination Charges for Mobile Phone Networks; Gans, JS & King, SP 'Mobile network competition'; Gans, JS & King, S 'Using "Bill and Keep" Interconnect Arrangements to Soften Network Competition', *Economic Letters*, 2001, 71(3): 413–20; and Gans, JS 'An evaluation of regulatory pricing options for mobile termination services'.

[53] There are circumstances where a fixed line operator who is also a mobile operator does offer lower fixed-to-mobile call prices when calls are made to their integrated network. This type of price discrimination, however, only applies for a 'common owner' of the two networks. Otherwise, the fixed-to-mobile call rates and indeed the mobile-to-mobile call rates are the same regardless of the carrier the receiving party subscribes to. We discuss issues of price discrimination between commonly owned fixed and mobile networks below.

[54] In its inquiry into mobile termination, the UK Monopolies and Mergers Commission found that fixed line consumers had little knowledge of the mobile networks they were calling or of price differentials in carrier-specific call prices; see Monopolies and Mergers Commission , 1998, pp. 31–33.

[55] Gans, JS & King, SP: 'Termination Charges for Mobile Phone; 'Mobile network competition, customer ignorance and fixed-to-mobile call prices'.

[56] Gans, JS & King, S 'Using "Bill and Keep" Interconnect Arrangements to Soften Network Competition'.

[57] Armstrong, M 'The Theory of Access Pricing and Interconnection'; Wright, J 'Bill and keep as an efficient interconnection regime?' *Review of Network Economics*, 2002, 1: 54–60.

[58] Formally, the logic applied here assumes full mobile penetration. Wright (2002, Figure 2**)** calculates what happens to mobile network profits as termination charges are mutually adjusted when there is partial mobile penetration. From a starting point of high termination charges, a fall in those charges actually increases profits to a point and then for further falls there is a reduction in profits. So in contrast to the case of full mobile penetration there is an inverted U-shaped relationship between regulated termination charge levels of mobile carrier profits; in contrast to no relationship in the case of full mobile penetration.

[59] That is, the efficient investment pricing rules developed by Gans and Williams (1999a, 1999b) Gans, J.S. and P.L. Williams (1999a), "Access Regulation and the Timing of Infrastructure Investment," *Economic Record*, 79 (229), pp.127-138. Gans, J.S. and P.L. Williams (1999b), "Efficient Investment Pricing Rules and Access Regulation," *Australian Business Law Review*, 27 (4), pp.267-279.**]** and Gans, JS ('An evaluation of regulatory pricing options for mobile termination services') that are variants of two part tariffs.

[60] **[**Hausman, J. (2002) "Mobile telephony" in Cave, M., S. Majumdar, and I. Vogelsang (eds.), *Handbook of Telecommunications Economics*, North-Holland**]**

[61] See Competition Commission (UK) *Vodafone, O2, Orange and T-Mobile: Reports on references under section 13 of the Telecommunications Act 1984 on the charges made by Vodafone, O2, Orange and T-Mobile for terminating calls from fixed and mobile networks*, 2003.

[62] See: DeGraba, P 'Bill and keep as the efficient interconnection regime?: A Reply', *Review of Network Economics*, 2002, 1: 61–65; Wright, J 'Bill and keep as an efficient interconnection regime?'; and Gans, JS & King, S 'Using "Bill and Keep" Interconnect Arrangements to Soften Network Competition'.