Price Regulation of Mobile Termination: Promoting Competition and Investment in Telecommunications

A Report on behalf of Hutchison Telecommunications

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26th June, 2003

Executive Summary

In April 2003, the ACCC released an information paper *Mobile Services Review, 2003* and announced its intention to review the pricing methodology for mobile phone termination charges. As part of its current inquiry into mobile services regulation, the ACCC is considering:

(a) the need for regulation of mobile services including domestic GSM and CDMA terminating and originating services; and

(b) the form that any regulation should take.

In this report, we consider the need for regulation of mobile termination charges, the relationship between mobile termination charging and the regulation of fixed-to-mobile calls, and appropriate forms of regulation.

A consistent message from the academic research is that there are potential problems with market power in mobile termination services and regulation to lower the price of these services is desirable. These potential problems stem from two related sources. First, subscribers to mobile services generally care less about the price of fixed-to-mobile calls than about the price of retail mobile services. The reason for this is simple – the mobile subscriber in Australia does not pay for fixed-to-mobile calls but does pay for retail mobile services. Second, when a person makes a fixed-to-mobile call, they are often unaware of the exact mobile carrier who will terminate the call. This reduces competition between mobile carriers for call termination and provides incentives for mobile carriers to raise termination charges significantly above cost. At the same time, competition between mobile carriers means that termination revenues are often dispersed through lower prices for retail mobile services.

While mobile termination raises market power problems, issues of market power may also be relevant for the fixed-line services provided for fixed-to-mobile calls. If there is a dominant fixed line carrier then any reduction of mobile termination rates will not, by itself, lead to economically desirable fixed-to-mobile call prices. Rather, prices will remain inflated due to the ability of the fixed-line carriers to price above cost. Thus the regulation of fixed-to-mobile termination charges alone may be inadequate to guarantee economically appropriate pricing of fixed-to-mobile calls. Insufficient competition in the retail market for fixed-to-mobile calls means that fixed-line carriers may effectively short-circuit any regulatory attempts to improve fixed-to-mobile retail prices. As the regulator reduces fixed-to-mobile charges to better reflect cost, fixed line carriers may increase their 'share' of the retail price of a fixed-to-mobile call, resulting in customers receiving only part of the benefits of regulation.

If there is a need for regulation, what type of regulation is appropriate? We consider the existing regulation for fixed carriers and mobile carriers relating to fixed-to-mobile calls. We note that there are some significant problems with the existing regulatory regime. The existing pricing principles for mobile termination may reduce competition in mobile services. Further, the existing pricing principles for mobile termination and the current price cap regime imposed on Telstra may not be consistent. This means that a reduction in mobile termination charges under the existing rules may lead to little if any reduction in retail fixed-to-mobile call prices and may lead to an increase in the prices of mobile services. Such a result, while potentially creating a windfall gain to Telstra, would harm end-users.

We consider a range of alternative regulatory responses. For mobile termination charging two approaches dominate. The preferred approach depends on the degree to which mobile telephony has evolved as a direct network competitor to fixed-line networks for voice calls. If we view mobile networks as providing separate services to fixed-line networks then the appropriate regulatory price for mobile termination charging is marginal cost. If we view mobile and fixed-line networks as engaged in active network-to-network competition, then it is appropriate to have symmetric termination charging between the two networks. This could be based on current PSTN termination charges.

As noted, regulating mobile termination charges will not necessarily result in efficient pricing for fixed-to-mobile calls unless there is consistent regulation for any dominant fixed-line network. We consider a number of alternative regulatory approaches that could be adopted to deal with issues of market power in fixed-line services. These range from mechanisms to improve transparency, through modifications of the existing price cap regime, to the introduction of alternative price caps for either fixed-to-mobile calls or fixed-line origination charges for these calls.

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1   Background[1]

In July 2001, the Australian Competition and Consumer Commission (ACCC) released its final report on the pricing methodology for GSM (mobile telephone) terminating services. This methodology was subsequently extended to CDMA mobile telephone systems.

In April 2003, the ACCC released an information paper *Mobile Services Review, 2003* and announced its intention to review the pricing methodology for mobile phone termination charges. As part of its current inquiry into mobile services regulation, the ACCC is considering:

(c) the need for regulation of mobile services including domestic GSM and CDMA terminating and originating services; and

(d) the form that any regulation should take.

The current regulations cover fixed-to-mobile termination but not mobile-to-mobile termination. The ACCC discusses its position at p.31-2 of *Mobile Services Review, 2003*. The ACCC argues that, because there is likely to be a roughly balanced pattern of calls between any pair of mobile carriers, reciprocal termination charges will tend to 'net out' between carriers. Further, if the mobile-to-mobile termination charges are the same as the fixed-to-mobile termination charges, this avoids any problems of call arbitrage, where an intermediate mobile carrier transits a fixed-to-mobile call between two other carriers purely to arbitrage price differentials.

For fixed-to-mobile termination charges, the ACCC uses a 'retail benchmarking approach.' "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." (*Mobile Services Review, 2003* p.32)

As noted in our earlier work, and as explained in section 2 of this report, fixed-to-mobile termination charges involve a number of unique economic issues that suggest that both economic efficiency

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[1] Parts of this paper are drawn and updated from our earlier work in this area: Gans and King (1999, 2000) and Gans (1999).

and the long-term interest of end-users will be enhanced by price regulation. In the absence of regulation, fixed-to-mobile termination charges, and hence the retail price of fixed-to-mobile calls, will not reflect the underlying economic costs of providing these services. This may lead to economic inefficiencies in the market for fixed-to-mobile calls. As we note below, competition in the provision of mobile services can result in artificially high fixed-to-mobile charges being transferred through to mobile service retail prices, resulting in inefficiencies in the broader provision of mobile services as well.

At the same time, it must be recognised that fixed-to-mobile termination charges are only one element of the price of a fixed-to-mobile call. Such calls are currently billed to the fixed-line customer by their relevant carrier. For many customers, this is the same carrier that provides them with domestic long-distance and international fixed-line telephone services. For these fixed-line carriers, fixed-to-mobile termination charges are a cost of providing fixed-to-mobile calls. But the retail price charged to customers for fixed-to-mobile calls not only depends on the termination charge. It also depends on other costs borne by the fixed-line carrier and the degree of competition in the provision of fixed-to-mobile calls. If competition in the provision of retail fixed-to-mobile calls is strong then we would expect that a reduction in fixed-to-mobile termination charges would lead to an equivalent reduction in the retail price of fixed-to-mobile calls. If competition in fixed-to-mobile calls is weak, however, a reduction in fixed-to-mobile termination charges may not be completely (or even substantially) passed through to retail customers.

From a regulatory perspective, this means that the regulation of fixed-to-mobile termination charges alone may be inadequate to guarantee economically appropriate pricing of fixed-to-mobile calls. Insufficient competition in the retail market for fixed-to-mobile calls means that fixed-line carriers may effectively short-circuit any regulatory attempts to improve fixed-to-mobile retail prices. As the regulator reduces fixed-to-mobile charges to better reflect cost, fixed line carriers may increase their 'share' of the retail price of a fixed-to-mobile call, resulting in customers receiving only part of the benefits of regulation.

If there is insufficient competition in the retail market for fixed-to-mobile calls, then the long term interest of end users may not be served by simply regulating the fixed-to-mobile termination price.

Additional intervention may be required to overcome the lack of retail competition.[2]

In Australia, the need for specific regulation of retail fixed-to-mobile call charges is reflected in the regulation of Telstra. Retail fixed-to-mobile calls sold by Telstra are covered by a general price cap. In other words, fixed-to-mobile calls sold by Telstra are one of a number of products that form a basket of retail products sold by Telstra that are constrained by a CPI-X price cap. Other products in the bundle are local calls and both domestic and international long distance calls (*Mobile Services Review, 2003*, p.17). The 'X' value is currently 4.5% per annum.

Macquarie Research Equities note that the price cap creates an issue for the regulation of fixed-to-mobile termination charges. Presumably, the aim of termination charge regulation is that it will lead to a lower price for fixed-to-mobile calls that better reflects the true economic cost of these calls. But, "[w]ithout a change in the price cap regime it appears unlikely that reductions in mobile termination charges will be fully passed through to consumers. Reductions in mobile termination charges at a greater rate than F2M charges would see a benefit to fixed operators including Telstra (net payers of mobile termination charges)".[3]

While fixed-to-mobile termination charges have fallen under the ACCC's regulated regime, it is not clear that these savings have been passed on to many of Telstra's retail customers. As *Mobile Services Review, 2003*, p.18 notes, Telstra reported for the purposes of the price cap regulation, that the prices of mobile services fell by 3.6% and 14.2% in the financial years 1999-2000 and 2000-2001 respectively. The ACCC, however, has expressed some concern over the veracity of these figures (*Mobile Services Review, 2003*, p.19). The ACCC also considers prices for fixed-to-mobile calls and notes real price decreases of between 5 and 8 per cent for 1997 to 2001 (*Mobile Services Review, 2003*, p.20).

Macquarie Research Equities, however, argues that the reported price decreases in fixed-to-mobile calls reflect savings solely to large

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[2] Indeed, as we noted in our earlier work, if there is a monopoly fixed-line carrier, then the regulation of fixed-to-mobile termination charges *at best* leads to monopoly pricing for retail fixed-to-mobile calls. Further, a reduction in fixed-to-mobile termination charges will not be fully passed onto end-users. Rather, with linear demand and constant marginal costs, approximately one half of any reduction in fixed-to-mobile termination charges will be seized by the monopoly fixed-line carrier.

[3] Macquarie Research Equities, *Telstra*, 7 April 2003, p.1.

corporate clients. In contrast, they argue that the prices of fixed-to-mobile calls sold by Telstra to household customers (for calls to non-Telstra mobiles) have risen in recent years (after adjusting for the GST). Thus, while corporate clients who buy bundled telecommunications products from Telstra appear to have received considerable savings from the reduction in mobile termination charges, these same benefits have not flowed on to smaller customers. Further, Macquarie Research Equities note that there is an increasing gap between the prices set by Telstra for fixed-to-mobile calls to Telstra mobiles and other mobiles.

Hutchison Telecommunications have also analysed the prices of fixed-to-mobile calls. Their analysis suggests that there has been little if any pass through of reduced mobile termination charges to Telstra's home and SME customers. Hutchison's analysis suggests that Telstra is offering significant discounts on fixed-to-mobile calls for corporate clients through bundled product offerings and that these bundled products may raise some competitive concerns for other fixed-line operators.

The analysis by both Macquarie Research Equities and Hutchison Telecommunications suggests that (a) competition in the retail provision of fixed-to-mobile calls for household and SME customers may be relatively weak, although this competition may be significantly greater for larger corporate customers; and (b) the current approach to regulating Telstra's fixed-to-mobile call prices through a general price cap is not leading to retail prices for fixed-to-mobile calls that pass through reductions in fixed-to-mobile termination charges.

CommSec argue that the 'feedback' structure included in the ACCC's current fixed-to-mobile termination regulations creates poor incentives for competition in retail mobile phone services. "The ACCC's retail benchmarking approach increases the cost to Vodafone and Optus of reducing mobile prices".[4] Put simply, if a mobile carrier such as Vodafone acts aggressively, reducing mobile prices to attract additional subscribers, then it will face a penalty through a reduction in its termination charges. This penalty will tend to moderate subscriber competition, potentially leading to higher prices for both mobile services and fixed-to-mobile calls.

It should be noted that this competition effect is not a result of the regulation of fixed-to-mobile prices per se. If termination charges are reduced for mobile telephone carriers then this will tend to lead to an increase in subscription charges, a reduction in mobile telephone

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[4] CommSec *Has the watchdog become Telstra's best friend?*, March, 2003, p.10.

subsidies and potentially an increase in mobile service prices, all else remaining equal. But these changes simply reflect that, given the degree of competition in mobile services, high termination fees can make it desirable to 'win' a mobile subscriber and lead to aggressive mobile service pricing. Regulating the level of termination charges leads to a rebalancing of mobile service prices but not a reduction in competition. The effect noted by CommSec is an additional strategic competitive effect. Thus, the form of regulation used by the ACCC not only leads to a rebalancing of mobile service prices but tends to mute on-going competition between mobile carriers.

At the same time, the removal of mobile services from Telstra's price cap (as opposed to fixed-to-mobile calls which remain in the price cap bundle) has reduced Telstra's incentive to lower mobile service prices. CommSec concludes that the ACCC mobile termination regulations together with the price cap changes mean that the "[m]ost likely outcome … is for all mobile carriers to leave their price unchanged" (p.20).

Any regulation of fixed-to-mobile termination charges must consider the rapidly changing nature of the mobile telephone industry. In developed countries the mobile telephone industry has grown rapidly over the past ten years. However, the ACCC, in its discussion paper, notes that in Australia, "since the 2000 financial year, growth in mobile subscriber numbers has been decreasing" (p.13) although subscriber numbers are still growing at more than 10 per cent per year.

The change noted by the ACCC for Australia is mirrored by a number of overseas studies with mobile penetration following an S-shaped path. Further, as mobile telephone penetration increases in developed countries, the interaction between mobile telephones and fixed line telephones changes. 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." (OFTEL, 2001, paragraph A1.14). However, recent research suggests that as mobile telephones become more widely adopted, they become a substitute for fixed lines. Cadima and Barros (2000) find that the ability to access mobile telephony reduces demand for fixed-line services. The availability of mobile services leads to approximately a ten percent decrease in the fixed-wire telephony penetration rate in their study. Sung and Lee (2002) 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 telephone networks move into competition with each other, the approach that should be taken to telephone regulation changes. To the extent that a customer chooses between a fixed line and a mobile telephone for their voice calls, telephony moves from an environment with a single ubiquitous fixed line network to an industry with competing fixed-line and wireless networks. This does not mean that the need for regulation disappears, but rather that the type of regulation changes. In Australia, fixed-line and mobile networks continue to be treated separately for regulatory purposes. However, as the mobile telephone industry develops, desirable regulation is likely to be more symmetric – for example, treating mobile termination and fixed line termination for voice calls as essentially the same product – a network termination service that just happens to be available using different technologies.

In this report we consider the economics underlying fixed-to-mobile termination prices and appropriate regulatory solutions. We use the recent Australian experience both as a back-drop to our economic analysis and as a starting point for considering regulatory alternatives. Section 2 of this report outlines the issues of market power in the provision of fixed-to-mobile calls. Section 3 focuses on the mobile carriers and considers appropriate regulatory solutions for these carriers. Section 4 considers issues that relate to the fixed-line carriers and the potential regulatory failure that can arise when there is insufficient competition in the retail provision of fixed-to-mobile calls. Section 5 concludes, while the appendix provides a technical analysis of issues in Ramsey pricing.

2 Assessing Market Power in the Provision of Fixed-to-Mobile Telephone Services

The first task in assessing both the need for and appropriateness of price regulation in telecommunications is an assessment of market power. For fixed-line telecommunications services, the source of market power is often control of the copper-based Customer Access Network (CAN). In contrast, for mobile telephone services, there are many providers of mobile carriage services who actively compete for customers. This suggests that there should be fewer market power issues in mobile telephone services than in fixed-line services.

However, the intensity of competition for mobile subscribers can mask less-obvious sources of market power in mobile telephone services. As we noted in our earlier work in this area (Gans and King, 1999, 2000, 2001; Gans, 1999), 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 (1) the way customers utilising mobile termination services perceive their competitive options; and (2) the nature of the interconnection behaviour of mobile carriers.

In this section, we review the arguments relating to market power in mobile termination services and demonstrate that there is a market power issue for these termination services both from fixed and mobile calls. We briefly review a variety of issues relating to market power in fixed-to-mobile calls including vertical integration, the problems of a lack of competition in fixed-line services, and the evolution towards direct competition between fixed and mobile services for voice calls.

2.1 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, or the A-party to the call, pays the price of the call, but the receiving party (the 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.[5]

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[5] 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

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.[6]

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

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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.

[6] 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 MMC (1998, pp.31-33).

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.

Take the plumber example presented above. If the A-party cannot distinguish the identity of the terminating network before they make their call, then this identity is irrelevant to the decision about which plumber to call. The person may call a plumber on a network with high or low termination charges, but they are only likely to know this when they receive a bill. It is then too late for the A-party to change their calling decision. The plumber on a network that has high termination charges is no longer penalised through fewer calls for these charges, and so does not even indirectly bear these charges. In fact, to the degree that a network might pass some of these high termination charges back to a customer through lower prices for calls originating on the mobile network, the plumber might have an economic incentive to join a network with high termination charges.

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.

2.2 Termination charging as an issue in two-way access

It is worth emphasising here the difference between issues that arise from termination as opposed to those that arise when pricing access to essential facilities. Both share in common the idea that what is being priced is an important input into a service. For termination, this is an input into an inter-network call service. For access, what is priced is an input into downstream production. However, it is the horizontal interactions between networks that distinguish termination issues from access issues.

To see this, recall that the issue in access is the leverage of monopoly power. That is, regulators are concerned that a firm with a monopoly or near monopoly in one part of the vertical chain of production might use that monopoly power to extend monopoly practices and pricing downstream. Specifically, the firm that controls the essential facility might price in such a way that few firms are able to operate downstream and/or so that downstream prices are inflated. In this situation, the role of regulation is to facilitate downstream competition that might otherwise be harmed by the behaviour of the owner of the essential facility.

In contrast, termination services arise when networks interconnect with one another. For any-to-any connectivity, each established network is equally important in the sense that a person who subscribes to one network can only call a person subscribed to any other network if its own network is able to terminate calls on every

other network. Thus, termination creates an issue of market power because every relevant network is equally 'essential' for ubiquitous calling.

As noted above, however, it is not simply interconnection but the structure of termination services that creates potential issues of market power. If termination services were structured differently – for example through different billing procedures or by using procedures to reduce customer ignorance – then much of the potential for abuse of market power in termination services would disappear. We discuss some of these structural solutions to the problem of call termination and market power below.

The two-way nature of termination services means that appropriate regulation will often be different to the regulatory solutions designed for a one-way essential facility problem. The source of market power relates to customer ignorance, so regulatory solutions could deal with this issue directly. Alternatively, regulation could be aimed at termination charges. However, when mobile carriers are competitive in retail services, any regulation of termination charges will feed back into the price of retail services. Revenues from termination charges are potentially used as a means of cross-subsidising competition on main network services. This has three immediate effects relative to standard one-way access regulation.

1. The investment issues that dominate one-way access regulation (e.g. arguments about allocation of common costs) are less relevant for two-way access where only termination charges are regulated. This is because any relevant fixed costs will generally be common costs of terminating and originating services and these fixed costs can be recovered through the retail mobile services. Thus approaches to regulatory pricing, such as marginal cost pricing, that have limited application in one-way access due to the need to recover fixed costs through the access prices can be applied to mobile termination charges with little if any concern about on going investment.

2. Following from this, the termination prices and the prices for retail mobile services are closely connected. Hence, when considering direct regulation of mobile termination charges, the regulator is faced with difficult questions regarding the balance of prices among different network services, including termination

services and cannot simply consider the pricing of termination services without examining the consequences for other prices.[7]

3. Because termination charges are both costs and receipts for each carrier under two-way access, relatively simple approaches such as reciprocal pricing can be appropriate regulatory solutions. While these may not lead to first best outcomes, they can lead to appropriate second-best regulatory solutions. It is worth noting that mobile-to-mobile termination charges have not been declared and these reciprocal charges generally 'balance' between mobile networks. As mobile networks mature so that mobile and fixed networks are in active competition, such reciprocal termination charging is likely to be an optimal regulatory approach for termination between these two networks.

While our focus in much of this report is with the issues of customer ignorance and termination charges, the economics of two-way networks also highlights that interconnection charges might be more generally used to distort competition. We discuss regulatory issues relating to interconnection charges when considering mobile-to-mobile pricing below.[8]

2.3   Does vertical integration help?

Our earlier analysis (Gans and King, 1999, 2000) focussed on situations where mobile and fixed line carriers were vertically separated. This separation leads to inflated termination prices, as is well known in economics.[9] If the fixed network and the mobile carrier are two separate companies, and these companies cannot bargain perfectly over non-linear termination charges, then the vertical separation will lead to 'double marginalisation.' The mobile carrier will tend to raise the price of termination above marginal cost so as to increase its own profits. But this raises the cost of mobile call termination as seen by the fixed network. To the extent that the fixed network has any market power, it will tend to set its fixed to mobile call prices by marking up this price over cost. However, the cost observed by this fixed carrier is not the true marginal cost of termination, but the higher termination price set by the mobile

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[7] We note that this view of the appropriate market is shared by the ACCC in its discussion paper *Mobile Services Review, 2003*, p.41.

[8] For a more extensive discussion of this point see Armstrong (1998).

[9] See, for example, Perry (1989) and King and Maddock (1996), Chapter 4.

carrier. As a result, termination charges tend to be marked up over cost twice – once by the mobile carrier and once by the fixed carrier. In the extreme, this can lead to pricing above the vertically integrated monopoly price.

Vertical integration mitigates such effects. A profit maximising vertically integrated network will either explicitly set internal termination prices equal to marginal cost or, when it prices its fixed-to-mobile and mobile-to-fixed calls, it will do so on the basis of marginal cost termination pricing. Even if its customers are ignorant of the mobile carrier they are calling, the prices of calls to mobiles will be based on a weighted average of termination charges it pays to other mobile carriers and its own marginal cost. In contrast, a fixed line network that is not integrated into mobiles will base its retail charges only on the weighted average of termination charges. It is easy to see here that if termination charges are set above marginal cost, the integrated carrier will have an increased ability to lower its retail prices in competition with the non-integrated carrier.

While vertical integration can lead to improved retail pricing outcomes it can also lead to significant problems when the pricing violates basic principles of competitive neutrality. To see this, consider the problem facing a new mobile telephone carrier when competing against a vertically integrated rival. The integrated carrier will have an incentive to raise the termination prices that it sets for its non-integrated rival above the true incremental cost of providing those termination services. This raises the costs faced by the non-integrated carrier making it difficult for that carrier to compete with the integrated firm. The integrated firm faces the true costs of terminating mobile calls to the fixed-line network while the rival non-integrated mobile carrier faces inflated charges. As a result, entry by competing mobile carriers will be constrained and competition will be reduced.

The same problems arise for a firm considering entry into fixed-line services against an integrated carrier. Again, a non-integrated fixed line carrier will find it difficult to compete on charges for calls to the integrated mobile network. Overall, vertical integration can harm the prospects for entry into specific telecommunications segments; forcing entrants to either be integrated or not enter at all.

2.4 Network externalities and termination charges

When regulation of mobile termination charges was first raised by the ACCC, a number of mobile carriers argued that their termination charges were not excessive due to the presence of *network externalities* between phone customers. These externalities exist if there are benefits to one consumer who buys a product when other consumers choose the same product. For example, when choosing a computer operating system, a customer might be more willing to buy a particular system if a significant number of other consumers either have already bought this system or are likely to buy this system.

It could be argued that having an additional mobile subscriber benefits fixed line customers, particularly given the historic importance of fixed-to-mobile and mobile-to-fixed calls.[10] But at best, this is an externality that will apply to relatively immature mobile networks and is general across all mobile carriers. It is far from clear that there are any direct network externalities for a specific mobile carrier. For fixed-to-mobile and mobile-to-fixed calls, the identity of the specific mobile carrier is irrelevant. If a customer is connected to one GSM network then there appears to be little difference in calling benefits whether another customer is connected to the same GSM carrier or a different GSM carrier. Even if customers are connected to different mobile systems (e.g. a GSM mobile call to a CDMA mobile phone) then termination can occur through the fixed line network. In this sense, any argument for setting mobile termination charges above cost to reflect the benefits of network externalities is not carrier specific.

At best network externalities provide a weak argument for setting termination charges that are not cost reflective. But, more importantly, mobile carriers might have an incentive to use termination charges to artificially create these externalities for anti-competitive purposes. For example, if a dominant mobile carrier wanted to stifle competition from a new entrant, it could set high call

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[10] Wright (2002b) presents this argument in relation to fixed-to-mobile termination charges. DeGraba (2002) notes that Wright's argument rests on a number of implicit assumptions. In particular, it assumes an asymmetry between the fixed line and the wireless networks, with lower demand elasticities for fixed-line services. It also assumes a relatively immature wireless network so that customers do not view mobile telephones and fixed line telephones as substitutes. As noted in the introduction, empirical studies suggest that in countries such as Australia with relatively high mobile penetration rates, that mobile and fixed-line telephones are behaving more like substitute products over time.

termination charges for that entrant. The dominant carrier's existing customers will be largely unaffected by these charges, but the new carrier's customers will face a high price when ringing the dominant mobile carrier. This can be a significant disincentive from joining the new carrier, particularly as mobile-to-mobile calls become more common. There is a network externality because the high inter-carrier mobile-to-mobile charges make it cheaper for customers to ring each other if they all belong to the same (dominant) network.

In summary, for relatively mature mobile telephone networks, arguments for a general 'network externality' for mobile services, in our opinion, are weak. Further, non-reciprocal termination charging regimes that lead to price differentials between on-net and off-net charges may artificially create network specific externalities that can lead to barriers to entry and diminished competition.

2.5 Competition in fixed-line services

Our discussion so far has focussed on the issue of customer ignorance and the implications of this for market power in the provision of mobile termination services. However, even in the absence of customer ignorance, the retail price of fixed-to-mobile calls will not be set at a competitive level if there is a lack of competition in the retail provision of fixed-to-mobile calls.

To see this, suppose that there is a single monopoly fixed-line carrier. Under customer ignorance, mobile carriers will set termination charges above cost and double marginalisation will lead the monopoly fixed-line carrier to set a retail price for fixed-to-mobile calls that *exceeds* the integrated monopoly price. This is undesirable for all parties – the fixed-line carrier, the mobile carriers and customers. But if regulation solely focuses on the price of mobile termination services, then even pricing these services at marginal cost will only lead to a monopoly retail price for fixed-to-mobile calls. Put simply, if the monopoly fixed-line carrier faces the true marginal cost of a fixed-to-mobile call because mobile termination charges are set at marginal cost, then this means that the fixed-line carrier will set the profit maximising retail price for fixed-to-mobile calls. This is the monopoly price. While, from the end-users perspective, such a monopoly price is better than the unregulated price with double marginalisation, the monopoly retail price for fixed-to-mobile services is still likely to lie significantly above the economically efficient price.

While competition in fixed-line services will reduce the retail price of fixed-to-mobile calls, if there are problems of market power in fixed-

line services then the possibility of inefficient above-cost pricing remains relevant. Even if mobile termination charges are set equal to marginal cost, if there is imperfect competition in the provision of fixed-line services then the retail price of fixed-to-mobile calls will be above the true cost of providing those calls.

The existence of market power in the market for fixed-line services has a number of implications for the regulation of mobile termination charges.

1. If mobile termination charges are reduced but fixed-line services are imperfectly competitive, then the full reduction in termination charges will not be passed on to end users. Rather, the retail price of a fixed to mobile call will fall by less than the reduction in mobile termination charges.

2. If mobile termination charges are reduced but fixed-line services are imperfectly competitive, then a reduction in mobile termination charges will lead to an increase in fixed line profits. In this sense, the regulation of mobile termination charges without concomitant regulation of fixed-line carriers can lead to a wind-fall gain in profits for fixed-line carriers.

3. If mobile termination charges are reduced but fixed-line services are imperfectly competitive, then even regulating mobile termination services at marginal cost will not result in economically efficient pricing for fixed-to-mobile calls. This has led some commentators to argue that it might be appropriate to price mobile termination charges below marginal cost in order to try and offset the market power of fixed-line carriers and their tendency to raise retail fixed-to-mobile call prices (Armstrong, 2002).

4. If both mobile termination charges and retail fixed-to-mobile prices are regulated then this regulation must be consistent if it is to result in benefits to end-users.

To see this latter point, consider a monopoly fixed-line carrier who faces specific price cap regulation on retail fixed-to-mobile calls. Further, assume that the price cap is set at less than the integrated monopoly price of fixed-to-mobile calls. Finally, assume that the price cap is set on a standard CPI-X basis where X is not adjusted for termination charges. Then, if the regulator reduces mobile termination charges, this will have no effect at all on the retail price of fixed-to-mobile calls. The reason for this is simple. The monopoly fixed-line carrier will find it profit maximising to set the retail price of fixed-to-mobile calls equal to the price cap. Any reduction in mobile termination charges will lower the fixed-line carrier's costs but will

not alter the capped retail price. So it is still profit maximising for the fixed-line carrier to set the retail price equal to the price cap. The reduction in mobile termination charges will provide a windfall profit gain to the fixed-line carrier and will provide no benefit to end-users. In fact, as noted above, mobile termination charges and mobile service charges are linked. Thus, if the fixed-line carrier faces a standard price cap, a reduction in mobile termination charges could result in (a) a windfall profit gain to the fixed-line carrier; (b) no reduction in the retail price of fixed-to-mobile calls; and (c) an increase in the retail prices of mobile services. Thus such inconsistent regulation would be of detriment to end-users.

2.6 Competition with fixed line telephony

Most discussions of mobile telephone competition have abstracted from its broad role as a potential alternative to fixed line telephony.[11] As mobile penetration increases, consumers increasingly are able to choose the means by which they make and, indeed, receive calls. Thus, competition in mobile telephony can to some extent substitute for a lack of competition on fixed lines.

It should be recognised that once a call is connected between a mobile carrier and a fixed line network, the costs are independent of where the call happened to originate. This suggests that as a first approximation, both competitive neutrality between these networks and the efficient utilisation of call services require that two broad pricing principles need to be met:

1. the price of fixed-to-mobile calls should be the same as the price of mobile-to-fixed calls; and

2. where there is a dominant fixed-line carrier that is vertically integrated with a mobile carrier, the prices of fixed-to-mobile calls and mobile-to-fixed calls either originating or terminating on the dominant fixed-line network should be the same regardless of the identity of the mobile carrier.

Neither of these principles is currently met in Australia. First, there is an asymmetry in the termination charges depending upon the call direction. PSTN termination is implicitly regulated and involves much lower charges than current mobile termination rates. If the PSTN termination rates are cost reflective while mobile termination rates are

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[11] For an exception, see Gans, King and Wright (2003).

not, then too few calls will be made by those on fixed line networks relative to calls made from mobile networks. The asymmetry means that fixed line carriers will find it more difficult to compete for call revenue than mobile carriers. It would appear unlikely that this type of asymmetry can be good for consumers who should not face distorted pricing signals as to their choice of whether to use a fixed line or mobile option.

Second, discriminatory pricing for fixed-to-mobile calls exists with Telstra setting lower prices for fixed-line calls to its own mobile phones than to other mobile phones under a variety of calling packages for fixed-line customers. This price discrimination might have two sources. First, it might reflect that mobile termination rates are set above cost. When Telstra terminates a call on its own mobile network then it will face the true costs of call termination. In contrast, if it terminates a fixed-line call on another mobile network and the termination charges for that network are set above the true costs of termination, then Telstra will face a higher cost for that call. It is unsurprising in that situation that calls from Telstra fixed to Telstra mobile exceed those from Telstra fixed to other mobile carriers.

Alternatively, discriminatory pricing can be used to create network benefits particularly where a group of related customers, such as the employees of a single firm, care about both mobile originating and terminating call prices for calls to other members of the same group. To see this note that, unlike general calls where customer ignorance over the terminating mobile carrier is likely to hold, for calls within a well defined group, the identity of the mobile carrier is likely to be known. This is most obviously the case for calls between employees of the same company or between members of the same household. In such situations, if the dominant fixed-line carrier also owns a mobile carrier then it will pay the fixed-line carrier to offer 'packages' or bundled products to companies or families with reduced fixed-to-mobile rates for calls to the fixed-line carrier's own mobile network. This type of package can only be offered by a carrier that is integrated into both fixed and mobile services. This form of pricing makes it attractive to the customer group to purchase all their fixed and mobile services from the one carrier. If they purchase fixed services from the dominant fixed-line carrier and mobile services from another carrier then they know that, on average, they will face higher prices for fixed-to-mobile calls. Thus, by using discriminatory pricing, particularly as part of targeted bundled products, a fixed-line carrier can undermine the competitive position of non-integrated mobile carriers.

2.7   Summary

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, where-by 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.

The regulatory problem created by terminating access is distinct and different from the standard issues of essential facility access. Unlike essential facility access, where the regulatory problem relates to pricing in a vertical production chain, termination charges relate to two-way networks. These charges create a regulatory problem because they involve the ubiquity of interconnection between telecommunications networks. In this sense they relate to complementary inputs produced by horizontally related firms. In fact, some degree of vertical integration may reduce the problem of excessive termination charging, albeit at the expense of creating other potential competitive problems.

If there is market power in fixed line services then these services must be regulated in a consistent manner with any regulation of mobile termination charges. Inconsistent regulation may be harmful to customers, leading to windfall gains to fixed-line carriers but higher prices for some services purchased by end-users.

When considered as an issue between complementary producers, termination charging can really be seen as an issue of network interconnection. Historically, mobile-to-mobile call volumes have been relatively low compared to fixed-to-mobile and mobile-to-fixed call volumes. But as mobile telecommunications matures, this historic asymmetry will disappear. At the same time, asymmetries are embedded in current Australian pricing and regulation and these asymmetries risk distorting the evolution of telephone services. In particular, while PSTN terminating charges are broadly cost based, the same does not hold true for existing mobile termination regulation.

Finally, asymmetries between networks in Australia exist and potential competitive problems, for example, due to bundling and vertical integration, cannot be ignored. Determining a regulatory solution for

termination charging cannot be isolated from broader issues of mobile telephone competition.

3 Regulatory Response for Mobile Termination

In section 2, we briefly outlined the issues that underlie market failure in termination charging for mobile telephones. But how should regulators such as the ACCC deal with these potential problems? In this section we look to the formal economics literature on network regulation for guidance and present a number of regulatory options to deal with mobile termination charging. We also use our professional judgement to evaluate these options.

Before considering alternative regulatory solutions, we review the economic literature relating to mobile termination. This literature has broadly approached the problem of mobile termination charging from two different directions. First, there is the significant literature on fixed-to-mobile calls and termination charging. This literature begins from the assumption that most calls are fixed-to-mobile and mobile-to-fixed so that mobile-to-mobile calls can be ignored. Second, there is a growing literature on network-to-network pricing. When applied to mobile termination charging, this literature effectively treats all calls as mobile-to-mobile calls.

Clearly neither of these literatures provides a perfect analysis of the problem of mobile termination. In large part, this reflects the evolutionary nature of the telephone industry. As noted in the introduction, developed countries like Australia are moving from a situation where mobile telephones were largely complimentary to the traditional fixed-line network, to a situation where true network competition between both mobile networks and the traditional fixed line network is becoming a reality. This is most obvious for voice calls, but will move towards data services over time.

To deal with this evolving situation, regulators must be careful to construct rules that both deal with the current potential abuse of market power while not undesirably distorting the process of evolution in the industry. This suggests that structural procedures might be desirable either as an alternative to price regulation or as an adjunct to that regulation. In the second part of this section we consider such structural approaches to regulation, while in the final part of this section we look at alternative approaches to price regulation.

3.1   Unregulated Outcomes

3.1.1   Fixed-to-Mobile Termination and Call Charges

As discussed above, it is a basic fact of terminating services that the providers of such services have a certain degree of market power in setting terminating charges. Consider a mobile network with a given customer base. Even if that base is small, callers from other networks to those customers will have to pay a price for calls to that network that is in part influenced by the terminating charge set by that mobile network. And it is true that as the price of fixed to mobile calls rises, fewer such calls will be made. The elasticity of demand for fixed to mobile calls will, therefore, temper the market power of any mobile network. However, this effect is limited by customer ignorance. What this means is that if a specific mobile network raises its termination charge this will influence the average number (or length) of fixed to mobile calls to all networks but will not cause the specific network to receive proportionately fewer calls than other mobile networks. This is because callers to mobile networks tend to respond to the overall price of fixed to mobile calls and generally cannot distinguish any price differentials that might exist in calls to alternative mobile networks.

This means that unregulated mobile termination charges can result in fixed-to-mobile call prices above those that would arise under monopoly conditions. This outcome is a combination of consumer ignorance and horizontal and vertical separation.[12] To see this, suppose there was only one integrated provider of mobile and fixed line services. That network will base charges for its terminating service on the actual marginal cost of termination. As it has a monopoly, its fixed to mobile price will be a simple mark-up over those marginal costs resulting in a monopoly pricing outcome for such services.

If the networks were not vertically integrated, with the mobile network setting its termination charge independently then, when it can only set a uniform termination charge, it is likely to set that charge above its actual marginal termination cost. Otherwise it would not make a profit. As noted above, the end result is what is referred to as 'double marginalisation.' As the mobile network raises the fixed network's marginal cost of fixed to mobile calls, the price of those

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[12] See Gans and King (2000) and Armstrong (2002). The most general statement of this result is in Wright (2002b).

calls is higher. This results in lower consumption, reduced consumer surplus and also lower profits for both networks than would arise under vertical integration. It is only when the two networks can negotiate non-linear termination charges (such as a two-part tariff) that the monopoly outcome will be restored with the termination charge set equal to actual marginal termination costs.

Horizontal separation of mobile networks combined with customer ignorance serves to exacerbate the double marginalisation effect; causing fixed to mobile prices to increase further. First, when consumers on the fixed network cannot easily determine the precise price of the mobile network they are calling, the fixed network can do no better than set the same fixed to mobile call charge regardless of the network being called. This price will be set on the average termination charges. Consequently, an increase in one mobile network's termination charge will raise this average and raises fixed to mobile prices in general, rather than simply raising the price to the network with the inflated termination charge. Put simply, the mobile carrier that raises its termination charge gets all the benefit of that price increase (in terms of greater revenue from each fixed-to-mobile call it receives) but shares the economic cost of that price rise, as it only suffers a proportion of the fall in fixed-to-mobile calls. Thus, an increase in one network's termination charge has a negative external effect on the termination profits that other mobile networks receive. Indeed, the smaller (in terms of market share) the mobile network, the less likely is it to internalise the demand-reducing effects of an increase in its termination charge. So the *less concentrated* the mobile network market, the higher will be the level of fixed to mobile call charges.

This effect is strengthened further when mobile networks recognise the influence of termination profits on their own competitive interactions. When competing against each other, mobile networks will recognise that attracting a customer not only gives them revenues from the calls made by that customer but also termination revenues from calls made to that customer. A mobile network with a higher termination charge will, therefore, receive more profits from a given customer without any reduction in calls to that customer; the calls to that customer are not influenced by the network they subscribe to because the caller cannot identify this network. So by having a higher termination charge, a mobile network effectively receives greater benefits from attracting a given customer and hence, can afford to offer more attractive subscription terms to that customer. What this means is that in competing for a customer, a network is going to be able to afford to offer better terms to a customer if its per customer termination profits exceed that of other networks. Because of customer ignorance, by increasing their own termination charge, a

mobile network will improve its competitive position to the detriment of other mobile networks. Competition will, therefore, drive termination charges upward. Indeed, it is possible that this interaction could go so far as to 'choke-off' fixed to mobile demand entirely.[13] That is, termination charges may, in equilibrium, be so high that the fixed carrier is unable to profitably offer a fixed to mobile service.

One response to this may be for the fixed network to utilise its monopoly position to favour one mobile network relative to another. Other non-favoured networks may be required to pay higher termination charges for mobile-to-fixed calls made from their networks to the fixed network. This would leave the non-favoured networks in a weakened competitive position and hence, price competition among the mobile networks would be weakened. This, in turn, would enable the favoured mobile network to seize a greater market share and (as it then supplies a larger fraction of the fixed-to-mobile calls) would lead that favoured carrier to reduce its mobile termination charges. In effect, a fixed and mobile network would be getting together in a form of 'quasi-integration' to eliminate the negative externalities associated with customer ignorance and vertical separation. This, of course, would have a detrimental effect on the degree of mobile network competition and would potentially eliminate non-favoured mobile networks.

The potential for explicit or implicit integration between the fixed network and one mobile network to reduce mobile termination pricing by simultaneously reducing or eliminating mobile service competition, is unlikely to be a palatable regulatory solution. However, in the absence of any favouritism, vertical integration does not significantly improve the problem of market power and mobile termination charging. Integration will tend to reduce the average termination charge, as the integrated firm sets its implicit termination charge equal to marginal cost. But this will cause the non-integrated mobile carriers to raise their termination charges. The end result is that the integrated carrier will receive a lower level of profits than if it was vertically separated and integration without favouritism will not be advantageous. Only when integration leads to the ability to favour a single mobile network and soften price competition will such integration be profitable. This will reduce fixed to mobile prices but at the expense of a softening of price competition in the mobile market and the conferral of market power on the integrated carrier.[14]

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[13] See Gans and King (2000).

[14] See Gans and King (1999) for a model of this.

Finally, it is sometimes argued that mobile subscribers will have preferences for incoming as well as outgoing calls. Consequently, mobile networks may wish to utilise low fixed to mobile prices to attract consumers to their network and hence, lower their termination charges. However, so long as consumers on the fixed network are unable to distinguish between alternative mobile networks when making calls, their demand will be based on an average price. As such mobile networks will be unable to utilise differences in termination charges to attract consumers to their network. So while a consumer preference for incoming calls may increase the attractiveness of subscribing to any mobile phone network; so long as there is customer ignorance, this will not exert any additional competitive pressure on termination charges.[15]

It is important to note that above monopoly pricing for termination services means that profits accruing to mobile carriers from termination are *lower* than they might be if termination charges were to be systematically lowered to the monopoly price. Thus, a lower termination charge may improve incentives to invest in mobile telephony.

In summary, there are two drivers for regulation of termination charges for fixed-to-mobile calls:

- Unregulated termination charges are set too high resulting in a loss of both consumer and producer surplus.

- The fixed line network may utilise discriminatory call prices to exclude some mobile networks.

Basically, in the absence of regulation, the termination service for calls from fixed line networks is used inefficiently as an instrument by which mobile networks and a fixed line carrier can leverage their market power over fixed-to-mobile calls to influence competition in the mobile call market. The end result is that fixed-to-mobile call prices will be too high and, potentially, may be used as an instrument to reduce competition in mobile telephony. There is potential, therefore, for regulation to improve consumer outcomes and also, industry profits; thereby, improving incentives to invest in the industry.

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[15] Armstrong (2002) argues that a call externality will tend to lower the unregulated termination charges. However, his derivation assumes that there is actually pass through of termination charges to fixed-to-mobile call prices; so that mobile subscribers can recognise which mobile carrier is likely to attract the most calls. This assumption is unlikely to hold given customer ignorance.

3.1.2   Mobile-to-Mobile Termination and Call Charges

Mobile networks also offer a termination service for each other's mobile-to-mobile call traffic. Such termination charges can directly impact upon a rival's costs. In particular, an insistence on a high termination charge may make a rival uncompetitive. However, when two networks are not close substitutes, termination charges will not be effective as an entry deterrence device. Indeed, it is possible that such charges may become an instrument of collusion to raise each other's costs and soften price competition.[16]

It should be recognised, however, that mobile phone competition is often based on non-linear pricing (e.g., two-part tariffs) that make this type of collusion less likely. When networks can offer consumers a two-part tariff, they will optimally set all usage or per call charges equal to marginal cost; appropriating profit margins through fixed subscriber charges. For intra-network calls, these charges will reflect true marginal costs while, for inter-network calls, they will include the rival's termination charge. If rival networks choose their termination charges independently, they will select charges above their actual marginal termination costs. This is because they neglect the negative effect a higher price has on their rival's profits generating a similar outcome to the double marginalisation effect rather than a collusive choice per se. Thus, inter-network call prices will be inefficiently high.

If mobile networks negotiate interconnect fees (as they can in Australia today), this can alleviate such double marginalisation effects. Under customer ignorance, mobile networks will be indifferent between the precise levels of the reciprocal termination charge that is chosen; their expected profits are the same regardless. Basically, if they each were to negotiate a slightly higher termination charge, this would increase their marginal call costs; being based on average termination costs, as intra- and inter-network call prices are effectively equal. To retain their existing market share, each network would have to reduce subscriber charges (or fixed fees) that they use to attract a customer. This would reduce profits to each network. This, however, will be offset by the increased profits from each networks' respective termination services. It turns out that this increase in termination profits exactly offsets the reduction in subscriber profits so that overall network profits remains

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[16] See Laffont, Rey and Tirole (1998a), Armstrong (1998) and Carter and Wright (1998).

unchanged.[17] In this respect, networks are indifferent to the level of the termination charge.[18,19]

One important implication of this is that if mobile networks negotiate over termination charges and set the same termination charges for mobile as well as fixed line calls, it is the fixed line termination choices that will drive all termination charges. Mobile carriers are indifferent to termination charges from other mobile networks but not to those from fixed line carriers; hence, they will negotiate their charges with a view to the latter.

In summary, therefore, the need for regulation of mobile-to-mobile charges is based on two concerns:

- Independently chosen termination charges may be set too high resulting in a loss of both consumer and producer surplus.

- Negotiated termination charges will likely be driven by desired outcomes for termination from fixed line carriers.

In practice, this means that mobile carriers will be relatively unconcerned about the levels of mobile to mobile termination

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[17] See Laffont, Rey and Tirole (1998a).

[18] Dessen (2001) demonstrates that this indifference continues to hold when network subscribers care about receiving as well as making calls.

[19] If customer ignorance did not hold – as it may for mobile-to-mobile calls – complications arise so that it is unlikely that negotiations will result in efficient outcomes. While it is true that, for this case, if termination charges are chosen independently, they are set too high (reflecting double marginalisation), when they are negotiated they may be set too low. Networks could use low termination charges – the so-called 'bill and keep' rule – to soften price competition. That price competition takes place as networks lower subscription (or fixed) charges to attract customers. If attracting a customer also attracts lucrative termination revenues for calls to that customer, this only serves to raise the stakes of building market share. On the other hand, a reciprocal bill and keep rule means that an additional customer brings with it a liability – in the form of costs but no revenue from termination. Hence, the benefits the network can potentially derive from an additional customer are less and it will soften its price competition in response. In equilibrium, negotiating a bill and keep rule keeps network profits high by committing networks to termination losses; effectively raising each other's costs (Gans and King, 2001).

This theory, while sound, does imply that off-net call prices will be below on-net call prices; something we do not actually see in reality. Berger (2002) demonstrates that when subscribers care about calls received as well as calls made, when networks compete in linear prices, they set a low termination charge to soften price competition. However, in this case, off-net call prices are above on-net ones; rationalising what we see in reality.

charges and will focus their attention – and regulatory concern – on the fixed-to-mobile situation.

3.2   Structural Changes

The ACCC has declared the GSM and CDMA terminating services. In its discussion paper it is re-evaluating the case for declaration and perhaps its extension to WCDMA. Thus far, we have demonstrated that in the absence of any regulation, termination charges will be set too high. These results suggest a role for regulation in curbing such potential abuse of market power. However, finding a regulatory option that fully resolves the concerns is difficult.

In this subsection, we consider a number of structural reforms that can help to overcome the regulatory problem of mobile termination charges. These structural options can either replace or assist more direct price regulation. Further, the structural options generally involve clarifying the nature of calling charges and making those charges transparent to customers. In this sense, the structural options are relatively light-handed interventions that do not risk distorting the evolution of network competition.[20]

3.2.1   Is negotiation enough?

At first instance, declaration mandates negotiations over termination charges. As already alluded to above, negotiated outcomes on termination charges are often superior to more arms length, posted prices as they eliminate the negative externalities associated with double marginalisation. But, mandated negotiations also make it more likely that larger networks and fixed line networks with market power will be able to use discriminatory termination charges to weaken or deter entrants from effective interconnection.

However, even in the absence of entry deterrence, negotiated outcomes are not perfect. On fixed to mobile calls, the best negotiated outcome is monopoly pricing of this service. In this respect, while mandated negotiations are desirable in curbing the worst aspect of termination pricing they are unlikely to result in socially efficient outcomes. Hence, such negotiations need to take

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[20] One option that we have not addressed is to provide mobile consumers with a 'receiver pays' option for fixed to mobile calls – as is practiced in the United States. Recent research suggests that this may have a beneficial effect on fixed to mobile prices and mobile competition. See Doyle and Smith (1998).

place in the shadow of stronger regulatory guidelines; an issue we return to in the following section.

3.2.2   Carrier Identification

One key problem for the pricing of mobile termination services is customer ignorance. Fixed-line customers are generally unable to distinguish between the alternative mobile networks they are calling. This means that price differentials among mobile networks – in particular, those driven by potentially different termination charges – do not cause asymmetries in calling patterns and termination profits to each mobile network. Thus, competition among mobile networks for termination revenues is muted.

This suggests that providing a means of carrier identification to consumers could help to break this competitive barrier.

> If a problem exists, it is because of customer ignorance of the charges they will pay for their terminating call. However, whether customer ignorance is a problem is not clear since many calls are repeat calls and customers receive itemized bills for their calls. But price regulation is not required to solve the problem if customer ignorance causes the problem. For terminating calls on mobile the operator could be required to identify itself, just as AT&T has done for many years in the U.S. when a long distance call is made on its wireline network. Consumer information would solve the potential market failure problem without the need for regulatory interference in competition and market determined prices. Both regulators and economists should first determine if a problem exists and then seek to solve the source of the problem, rather than turning to the highly distortionary solution of setting regulated prices, which has not worked well in the past in similar situations. (Hausman, 2002, p.596)

Specifically, we found that when consumers can distinguish between networks, termination charges are reduced; although they still result in call prices above monopoly levels due to the effect of double marginalisation (Gans and King, 2000).

Carrier identification removes the externalities associated with horizontal separation and makes possible termination charges closer to marginal cost. Indeed, when the fixed and mobile networks negotiate, they would try to agree to charges equal to marginal cost and the resulting call price would fall to a monopoly level.

Providing consumers with information regarding call prefixes would facilitate such identification in the short-term. But this form of network identification would weaken overtime with the introduction and spread of mobile number portability. Alternatively, perhaps a distinctive sound may be played when a call is places to a particular mobile carrier (such as Hausman notes is done for AT&T in the U.S.). Finally, greater advertising and awareness of any termination and fixed to mobile price differentials could encourage consumers to be aware of the carriers that friends, family and work colleagues subscribe to. These things would assist in making termination services more competitive.

This said mobile carrier identification will only improve mobile termination competition if differences in termination charges are passed through to customers through differential prices for fixed-to-mobile calls. To the degree that a dominant fixed-line carrier either faces regulations that limit the incentives for pass through, or has strategic incentives not to pass through reductions in mobile termination charges, further reforms are necessary. One such reform, direct termination charging, is discussed below. Section 4 deals with the issue of consistency between fixed-line carrier regulation and mobile termination regulation more broadly.

3.2.3   Direct Termination Charging

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.

Direct billing will not alleviate all issues of customer ignorance but it will help to educate customers about the different charges associated with different mobile carriers. From the perspective of competitive interaction, direct charging by mobile carriers reduces the worst aspects of double marginalisation. In particular, it treats the complementary products (fixed line origination services and mobile phone termination services) as complementary all the way to the consumer. In this sense, it respects the horizontal nature of network-

to-network interconnection rather than treating fixed-to-mobile calls as a vertically structured product. As such it should reduce the tendency for fixed-to-mobile calls to involve carriers marking-up already distorted termination prices when setting fixed-to-mobile call prices. Overall direct termination charging should result in lower fixed-to-mobile call prices.

Direct charging also introduces regulatory clarity. As already noted, vertical integration between a dominant fixed-line network and a mobile carrier can lead to distortions in the mobile telephone market. Direct charging makes any manipulation of prices clear and transparent. For example, if the integrated carrier favoured its own mobile network, for example by effectively setting a lower 'origination' charge for the fixed-line component of a fixed-to-mobile call, then direct billing would make such discrimination readily apparent. We return to issues of bundling in the next section.

Finally, a concern about mobile termination charges and highlighted by Macquarie Research Equities, has been the lack of pass through of reductions in mobile termination charges. As Macquarie Equities Research notes, under current regulations, any reduction in mobile termination charges can just be offset by a rise in the implicit fixed-line charge leading to no change in the overall price of fixed-to-mobile calls. Direct termination charging will make any such manipulation by the fixed-line carrier transparent. By breaking fixed-to-mobile call charges explicitly into a mobile termination charge and a fixed-line origination charge, any rebalancing of these charges becomes clear to both customers and the regulators. This has the additional regulatory benefit of allowing the regulator to 'check' for abuse of monopoly power by the fixed line carrier. The regulator can check the origination charge set by the fixed-line carrier for fixed-to-mobile calls with benchmarks, such as the charges for PSTN originating access. A significant disparity between these prices would suggest some regulatory problems.

3.3   Price Regulation

The most direct means of controlling anti-competitive pricing of termination services would be regulating those prices. Of course, this would entail all of the practical difficulties associated with such regulation but ultimately there would likely be a reduction in such prices and greater economic benefits from fixed-to-mobile calls.

Given the interdependencies identified earlier, it needs to be remembered that 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.*

Recall that, 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 could still be socially desirable as deadweight losses on the fixed to mobile service are reduced.

One objection to reducing mobile termination charges is that the resulting price may take no account for investments made by mobile networks in call termination. While this is true, the key issue is whether it matters from an efficiency perspective. That is, will such regulation diminish incentives to invest in termination services (or any other aspect of mobile telephony)?

To understand this issue, consider the effect of an increase in termination charges (above marginal termination cost) on mobile carriers. This rise means that they increase profits from termination. Those profits, in turn, mean that an additional customer is more lucrative to them in terms of overall profits. Hence, in attracting customers, the mobile network will be able to reduce its subscription fees with the increase in customer base outweighing losses in revenues from those fees. This is, however, unlikely to raise mobile carriers' profits in equilibrium because all mobile networks will act similarly. The end result is that all of the increased profits from termination are passed on to customers. So mobile networks are indifferent between the levels of regulated termination charges.

So whether termination charges are high (as they would be if left unregulated) or low (as they would be if they are regulated), this does

not alter a mobile network's profits.[21] As such, *so long as all mobile networks are equivalently regulated, the degree of regulation will not alter their incentive to invest.* Effectively, a termination service for off-network calls is incidental to the general termination service for all calls (on and off-net). Hence, there are few additional (common) costs associated with interconnection with fixed line services that would not arise anyway.

Note that this indifference does not mean that there are no economic benefits from lower termination charges. Competition means that changes in mobile carrier profits tend to be passed along to customers and double marginalisation in fixed-to-mobile call charges tends to lower both consumer surplus *and* industry profits from fixed-to-mobile calls. In this situation, lower termination charges will lead to greater economic surplus and benefits for customers.[22]

In this sub-section, we outline the pricing options available for fixed-to-mobile termination – either as guidelines to settle access disputes or as the foundation for an effective regulated price.

3.3.1   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

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[21] See Laffont, Rey and Tirole (1998a) for a formal proof.

[22] One qualification here is important, however. The above analysis considers interconnection between established carriers or carriers that do not directly compete with the mobile network. Therefore, it includes fixed-to-mobile termination and also termination between carriers with different geographic coverage. However, for mobile-to-mobile termination of entrant network calls to an incumbent network, marginal cost pricing may diminish the incumbent's incentives to invest in interconnection with such networks. This is the more traditional interconnection scenario in telecommunications (say between two local phone networks). In such cases, it will be desirable to take some account of investment costs in determining the termination charge set by the incumbent network. This could be achieved by using two-part tariffs that continued to set per call termination charges equal to marginal termination cost and also had a fixed fee to reflect investment costs. See Gans and Williams (1999a, 1999b) and Gans (2001) for a discussion of efficient investment pricing. To date, there is no research on the appropriate efficient investment price for interconnection.

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. As noted by CommSec, the overall effect should be to mute retail mobile competition.

3.3.2 Short Run Marginal Cost

As we demonstrated in our earlier work (Gans and King, 2001) and as has been confirmed by subsequent research (Armstrong, 2002; Wright, 2002), 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 fall to this level, 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 (i.e., $T < c_T$), 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 regulation, the costs of competing for mobile customers are increased. As such costs rise, prices will follow.

These considerations make benchmarking the appropriate termination charge difficult. What can be said, absent some other considerations discussed below, is that an *upper limit* on termination charges should be the marginal cost of terminating a call on a mobile network. This is the appropriate benchmark that would arise if fixed carriers set fixed to mobile call prices in a competitive manner.

How can short run marginal cost be determined? Let us denote this by c_T. It would be possible to use the lowest mobile call prices themselves to infer something about marginal costs. In particular, suppose that it was known that average trunk rates for mobile-to-mobile calls – say over long-distance lines – was c per minute. Thus, the total marginal cost of a call would be $c + 2c_T$ (the latter term assuming that it costs the same to originate and terminate a call).[23] If, in a particular period, the *lowest* per call minute price of a mobile call was p, then *if this price is close to a competitive level*, a good approximation for c_T would be given by $c_T = \frac{1}{2}(p - c)$. Hence, the upper limit on termination charges for fixed to mobile calls should be $\frac{1}{2}(p - c)$.

Note, however, that it is important that this not be a formulaic regulated price in the sense that it would be updated based on observed call prices. This would give carriers an incentive to raises prices and may lead to a further softening of mobile network competition. Instead, the regulated price could be based on current (pre-regulation) prices.

It needs to be remembered that the short run marginal cost represents an upper bound. In the presence of a fixed-line carrier that sets fixed-to-mobile prices above cost, the optimal termination charge would most likely involve a charge below marginal cost (i.e., below c_T). This may involve a termination charge of zero; akin to a 'bill and keep' rule between fixed and mobile carriers.

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[23] Some allowance would also have to be made for connection costs.

3.3.3   Long run marginal cost pricing

Pure short run marginal cost pricing would include congestion charges. If a mobile network became congested then the short run marginal cost of an additional call minute could become high, due to the risk of imposing drop-out and call failure on other users of the same network. In the extreme, as network capacity is reached, the short run marginal cost becomes infinite. This can have two effects. First, given the existing network capacity, short-run marginal cost pricing can become volatile if the network becomes congested in peak periods. Second, if networks are subject to regulated short-run marginal cost pricing, they might have an incentive to artificially congest their network in order to boost termination revenues.

These concerns about short-run access pricing for one-way access have led to discussions about long-run marginal cost. Long-run marginal cost pricing is the (uncongested) short run marginal cost plus the marginal cost of capacity expansion. As such, it does not vary with congestion as it has the cost of capacity expansion built in. Thus it can lead to more stable pricing and remove incentives for congestion manipulation.[24]

However, these concerns are less relevant for two-way access pricing. For example, suppose that a mobile carrier deliberately created congestion in order to boost the regulated termination revenues. Such congestion, with associated call failure, will affect those parties making and receiving mobile calls on that network. The mobile subscribers will bear the burden of the degraded quality and their most likely response will be to change mobile providers. In other words, unlike one-way essential facility access, mobile networks have to compete vigorously for customers and so face the cost of any network congestion through the loss of subscribers.

The second reason why there is little practical concern is that any measured marginal cost used by a regulator to set mobile termination charges (e.g. the method suggested above where cost is imputed from prices, or a cost based method based on the actual architecture of a mobile network) is likely to involve significant averaging. In other words, marginal cost measurements are likely to be similar to the average incremental cost of mobile termination services. These measurements would not allow for congestion variations.

In summary, while at a theoretical level, there can be disputation over whether short-run or long-run marginal cost pricing is preferable for

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[24] King and Maddock (1996) discus these issues for one-way access.

termination pricing, at the practical level and recognising the two-way nature of mobile services, any differences are likely to be small. *Overall, marginal cost pricing is likely to represent an appropriate second-best regulatory approach to setting fixed-to-mobile termination charges.*

3.3.4   TSLRIC

In its *Access Pricing Principles: Telecommunications*, the ACCC has stated that it favours a total service long-run incremental cost (TSLRIC) basis for setting the access price to declared services.

> TSLRIC is the incremental or additional costs the firm incurs in the long term in producing 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. As such, TSLRIC represents the costs the firm necessarily incurs in producing the service and captures the value of society's resources used in its production. (p.8)

The Competition Commission in the UK recently adopted this pricing benchmark for mobile termination, subject to some small variation (discussed below).[25]

In the context of mobile termination services, and where TSLRIC is strictly interpreted to exclude all common costs, it could be argued that TSLRIC pricing is essentially equivalent to marginal cost pricing. The termination service involves the carriage of calls from a point of interconnect to a mobile phone. Notice that this utilises the same infrastructure as is used for the termination of intra-network mobile calls; the only difference being where the point of interconnection is. So apart from the point of interconnection itself (something that is necessary for mobile to fixed calls), the infrastructure would be provided as part of operating a mobile network.[26] Hence, the fixed cost components of terminating fixed line calls are essentially the same whether such calls are terminated or not. In this sense, the only

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[25] See Competition Commission (2003). They refer to it simply as LRIC but it is essentially the same as the term TSLRIC as it is used in Australia.

[26] To put it another way, what is being argued here is that the extent to which infrastructure used to terminate calls from fixed line as opposed to origination and termination of intra-network mobile calls is common across those services, the costs should be allocated to the intra-network component rather than the termination service for fixed line calls.

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cost that would be avoided by not providing fixed line termination would be the marginal termination costs.[27]

In practice, debate in Australia (and overseas) about the costs that are included in TSLRIC and TSLRIC+, and the differences between these concepts, have led to significant disputation. Further, debate is confused by the parties using the term TSLRIC and the U.S. term, TELRIC as if they were interchangeable terms. In this sense, any statement by the ACCC that termination charges should be based on TSLRIC is likely to create significant confusion and will lead to disputation about whether or not common costs should be included.

The economically sensible basis for mobile termination charges is marginal cost. While marginal cost is likely to be similar to a strict economic interpretation of TSLRIC, we believe that regulatory clarity will best be served if the ACCC makes it explicit that they believe that fixed-to-mobile termination charges should be set on the basis of marginal cost.

3.3.5   Treatment of Common and Investment Costs

Marginal cost (MC) pricing does not include common costs in their calculations. This has raised concerns in other contexts that investment incentives might be reduced or that inequitable allocation of costs might arise. We deal with each of these concerns in turn, noting that in the mobile termination context, the traditional rationale does not readily apply.

3.3.5.1   Investment

If mobile termination charges are set at MC will this discourage investment in mobile infrastructure? The answer is no. The reason for this is simple. Our past modelling of competition in mobile telephony (e.g., Gans and King, 2001) demonstrates that mobile network profits do not alter as termination charges (for mobile to mobile or fixed to mobile calls) alter. To see this, suppose that a change in mobile termination charges leads to an increase in total termination profits for the mobile networks. (As noted above, this change may be either an increase or a decrease in termination charges depending upon the initial level of these charges). Then from the perspective of the mobile carriers, the increased termination revenues make it more

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[27] Note that, in line with the standard approach used by the ACCC, we are using the term TSLRIC to mean the long term incremental cost *without* any allocation of common costs. An allocation of common costs would convert the TSLRIC figure to a TSLRIC+ figure. The discussion here relates to TSLRIC, not TSLRIC+.

desirable to attract new subscribers, so that mobile network competition is intensified. In this situation, mobile subscription fees will fall, lowering mobile carrier profits. In equilibrium, these two effects offset each other. As a result, while the level of termination charges does affect social surplus and the benefits received by various market participants, it does not tend to alter total mobile carrier profits. Because of this, regulation of mobile termination fees will have no effect on either investment by existing mobile carriers or the entry of new mobile carriers.

While this result is strong, it suggests that any analysis that simply assumes that the regulation of termination revenues will affect either investment or entry is poorly founded. In the absence of any significant empirical or theoretical evidence[28] to the contrary, the correct starting assumption is that termination charges are both investment and entry neutral.

We do emphasise, however, that there is a need for research on the linkages between interconnection pricing and incentives to invest in infrastructure. While appropriate regulated pricing rules exist for traditional (or one-way) access issues that can generate socially optimal infrastructure[29] the interconnection issue is fundamentally more difficult; especially given the interaction between competition and horizontal trade between incumbent and entrants.

3.3.5.2 Common Cost Allocation

While the allocation of common and investment costs will not likely effect mobile carrier profits, it does impact on the relative charges and hence contributions made by mobile and fixed line customers. Hausman (2002) argues that some portion of the common costs of providing a mobile phone service should be borne by fixed line customers.

> Almost all participants in the debate acknowledge that competition among mobile providers works well, with increasing entry and decreasing prices.

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[28] Wright (2000, 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 a 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.

[29] That is, the efficient investment pricing rules developed by Gans and Williams (1999a, 1999b) and Gans (1999) that are variants of two part tariffs.

> Thus, no regulation is need here. The question is who will pay for the fixed and common costs of the mobile network; mobile subscribers or fixed to mobile callers? The Gans-King proposal of setting termination charges at marginal cost seems to make little economic sense. As Hausman (2000b) demonstrates, the standard Ramsey problem of the efficient method to cover the fixed and common costs will have both sets of customers paying above marginal cost to cover the fixed and common costs of the mobile networks. Indeed, given the estimated elasticities, the terminating call customers would pay a higher markup in an optimal solution rather than would the mobile originating call customers. Of course, a two-part tariff arrangement could be explored, but it is doubtful that regulators would require companies to pay a fixed charge for their customer's calls. (Hausman, 2002, p.596)

The UK Competition Commission agreed that some allocation of common costs was warranted.

> Some costs, however, are fixed and common to outgoing and incoming calls, and we allocated those costs on the basis that, because call termination charges are ultimately borne by the caller, the only costs that should be allowed should be those costs that the caller himself causes (which we term 'the cost-causation principle'). (Competition Commission, 2003, p.4)

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.

This was a view advocated by Hausman (2000). An implication of the Hausman approach is that uniform Ramsey pricing might provide an appropriate form of regulation for termination charges. Of course, uniform Ramsey pricing would only be an appropriate regulatory option if non-linear pricing were not possible. In the appendix we calculate the relevant formulae for optimal linear Ramsey pricing under the assumption that there is no customer ignorance and that the mobile subscriber cares about the quantity of fixed to mobile calls that they receive. It should be noted that the correct Ramsey rule in this situation is not a simple inverse elasticity formula. Rather, the standard inverse elasticity rule is reduced to allow for the positive externality created by the fixed line caller when ringing the mobile subscriber. This said, the Ramsey prices will be related to the inverse elasticity of demand.

Any implementation of uniform Ramsey pricing to fixed to mobile termination charges involves a number of steps. First, it is necessary to show the limitations on non-linear pricing, to justify the use of second-best linear prices. Second, the correct Ramsey formulae need to be calculated given the structure of the mobile phone industry. As noted in the appendix, the relevant Ramsey rules are unlikely to be the simple 'textbook' formulae. Third, the amount of capital required to be recovered through the uniform prices needs to be calculated. Finally, the relevant industry parameters, such as demand elasticities, need to be calculated.

As mentioned above and shown formally in the appendix, there is no reason why mobile network competition for subscribers will lead to socially optimal Ramsey prices for fixed to mobile termination charges. In other words, if it is felt that Ramsey pricing is appropriate, then mobile network competition will not, in general, lead to appropriate pricing.

In summary, as a matter of economics, it is far from clear that fixed line callers should bear proportionately more of common costs than mobile callers.

3.3.6   Network Externality Surcharges

As noted above, it has sometimes been argued that fixed-to-mobile termination rates should exceed marginal cost due to the presence of network externalities. But the argument for a 'network externality surcharge' rests on a number of explicit assumptions relating to both the source of any externality and to the relative elasticity of fixed and mobile demand.

Consider a situation where the number of mobile subscribers is elastic and is affected by the level of charges in the mobile market. Suppose, in addition, that the level of value received any caller (fixed or mobile) is positively related to actual penetration in mobile telephony. Basically, suppose that an additional mobile user adds benefits in essentially a linear way to existing callers.

In this situation, Armstrong (2002) demonstrates that the socially optimal termination charge may lie above termination cost; implying the validity of a 'network externality surcharge' as has been proposed in the UK. An issue is the size of this surcharge. Armstrong (2002) that the size of the surcharge is related to the size of:

$$\Lambda(a) = \frac{-(a - c_T)Q'(C + a)}{\pi_T'(a)}$$

where Q is the average number of fixed calls received by a mobile subscriber and π_T are per subscriber profits from termination. The intuition for this formula is based on the fact that there is a deadweight loss from subsidising mobile subscribers. Λ is the deadweight loss imposed on fixed line customers from this subsidy. Under perfect mobile competition, the subsidy paid to each mobile subscriber is the average termination profits generated, so a $1 worth of subsidy requires $1/\pi_T'$ extra in a; or in total Q/π_T' per mobile subscriber.

Given this, the mark-up over costs required is:

$$-\frac{\Lambda(a)}{Q'} = \frac{\Lambda(a)P}{Q\varepsilon}$$

where P is the fixed to mobile call price and ε is the price elasticity of demand for fixed to mobile calls. Notice that if ε is very high then the surcharge should be low. The same is true if mobile subscription demand is relatively inelastic. In general, the surcharge will be positive because a higher termination charge raises equilibrium mobile subscriber utility (via handset subsidies and the like) and hence, mobile penetration that itself benefits fixed line subscribers through the network externality effect.

If we assume that there is a network externality associated with the penetration of mobile telephony then the analysis presented by Armstrong can be used to rationalise a fixed-to-mobile termination surcharge. Note however, that this is not a justification for no regulation at all – prices in that case, even with the externality are well above socially efficient levels. Moreover, it is *not* a reason to increase charges in addition to a common or fixed cost allocation. It may, however, be a reason why such allocations may not be as harmful to allocative efficiency. Finally, if mobile subscribers receive utility from receiving calls, Armstrong (2002) demonstrates that this lowers the socially optimal termination charge; something that may offset the need for a network externality surcharge.

The above analysis started from the assumption that there was an externality associated with increased mobile penetration. As we noted above, this externality is likely to diminish as mobile penetration increases and as mobile services mature. In this sense, for standard GSM and CDMA services in Australia, the assumption that there is a non-trivial network externality associated with mobile penetration requires significant justification.

Even if the case were made for a mobile network externality, as with all such cross subsidisation arguments, there may be alternative means of paying the relevant subsidy that involves less distortion to consumer behaviour – e.g., through a service obligation fund as is done for fixed line telephony.

In brief, while a theoretical argument for a network externality surcharge can be made, it depends on the assumption that the externality exists and that alternative subsidy mechanisms cannot be used. At a minimum, detailed evidence regarding the existence of network externalities would have to be demonstrated – particularly given the high mobile penetration currently in Australia.

3.3.7   Retail Minus

The ACCC has used a retail-minus approach for pricing local call resale services. A retail-minus approach can be appropriate either where there is a relevant price cap in place for the final retail product (e.g. for fixed line local telephone calls) or where the regulator wishes to set strong incentives for access seekers to develop their own infrastructure.

A retail-minus approach does not seem appropriate for mobile termination services. Such an approach might be considered for mobile roaming services, but would need more thorough investigation.

3.3.8   The Need for Symmetry

It is sometimes argued that regulation of the termination charges of dominant mobile networks (i.e., those with the greatest market share) would suffice to ensure more efficient pricing of fixed to mobile calls. To be sure, the regulation of the termination charge of dominant networks to marginal cost will lower such prices. However, the beneficial effects of such regulation are partly offset by an increase in the termination charges of unregulated carriers. Thus, the reduction in fixed to mobile charges is not as great as it might be.

This suggests that there may be benefits to regulating all networks on similar terms. While regulating networks with the greatest market share will result in the largest reductions in fixed to mobile prices, this will make those networks less aggressive in maintaining their market share relative to those networks whose termination charges are not regulated. Hence, the regulated share will diminish relative to the unregulated share, raising average termination charges and hence,

fixed to mobile prices. The longer there is asymmetry in regulation among networks, the longer are potential losses in competitive neutrality among them likely to persist. In the short-term, this may assist entry. However, in the long-term this could lead to inefficient pricing outcomes.[30]

In any case, it is important that mobile termination charges *do not differ* depending upon whether the call originates from a fixed line or other mobile carrier. This is because each imposes the same costs on the mobile carrier and same potential benefits to its subscribers. Hence, asymmetric termination charges would distort consumer choice.

3.3.9   Pricing termination for network-on-network competition

The pricing approaches discussed so far tend to view mobile networks as distinct and economically different from fixed-line networks. Hence, the focus is on the correct price for fixed-to-mobile termination charges. As we have noted, economic analysis strongly indicates that the optimal regulated price in this situation should be based on marginal cost.

However, as we have also noted above, the interaction between mobile and fixed telephone networks is changing and maturing. As mobile penetration increases and mobile phones move from being complementary to fixed-line services to substitutes for fixed line services, the treatment of mobile and fixed networks as producers of distinct services becomes less relevant. Rather, as mobile telephony matures, the focus needs to be on mobile networks competing both with each other and with fixed line networks for the provision of telephony services.

Treating mobile and fixed services as alternative competing products in a broader telecommunications market does not mean that the differences between these services are ignored. Each of mobile and fixed services has distinct characteristics and will compete on their merits. The underlying costs of the services differ as does the benefits that they provide consumers. But the same can be said of any differentiated products that compete with each other. A Toyota Camry, a Holden Commodore and a Nissan Pulsar are all different cars. They each have different features in terms of size, power, fuel economy, comfort and so on. They also have different production

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[30] The issue of the regulation of termination charges for non-dominant networks is dealt with extensively in Gans and King (1999).

costs and different retail prices. But they also actively compete against each other in the broader car market.

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. As discussed in section 3.1.2, terminating charges might still be used as a device to soften inter-network competition and discriminatory practices involving on-net and off-net pricing are still possible.

However, viewing mobile and fixed-line networks as engaged in network-on-network 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 on-going economic research, as has been noted by the discussion of the economics literature earlier in this section. For example, there is debate about the desirability or otherwise of a zero termination charge, called bill-and-keep.[31] 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.

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[31] See DeGraba (2002), Wright(2002a) and Gans and King (2001)

One sensible approach that could be adopted by the ACCC is to 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.

3.3.10   Summary: Pricing Principles

In summary, if there is direct price regulation of mobile termination charges then such regulation should follow some specific economic principles.

1.   the same termination charges should apply over all carriers

2.   the termination charges should be based on marginal cost

3.   if there are to be any allocation of common and fixed costs to mobile termination charges then this allocation needs to be carefully considered. As a first pass, it is unlikely that an allocation of these costs that involves distorting the marginal termination charges would be desirable. Further, not having such allocation procedures will greatly simplify the regulatory process.

4.   if there is any claim for a network externality surcharge for mobile termination prices, then such a surcharge is only applicable in the early stages of mobile penetration and should be avoided as the mobile industry matures. The existence of such an externality has not to our knowledge been demonstrated for Australia.

Alternatively, the Commission could adopt a more forward-looking approach to the development of the telephony industry and begin to move termination pricing towards the reciprocal basis found under network-on-network competition. While there is debate in the economics literature about the optimal reciprocal price for termination, a sensible initial approach would involve the ACCC moving mobile termination charges down until they are in line with PSTN fixed-line termination charges.

3.4   Summary: Regulatory Options

In this section we have considered a range of regulatory approaches that could be adopted by the ACCC for mobile termination charges. We note that the ACCC's current regulatory approach to mobile termination charges (the 'retail benchmarking approach') may create significant competitive problems by reducing incentives for mobile carriers to compete vigorously for retail customers.

Regulatory options fall into two broad groups – structural reforms and direct price controls. These approaches are not mutually exclusive. Structural reforms such as direct termination charging and carrier identification can create significant benefits even in the presence of direct price regulation. We return to this issue in the next section. If direct price regulation is adopted then it needs to be symmetric between carriers and based on marginal cost. Alternatively as the mobile telephone industry matures, termination pricing can move to being reciprocal with fixed-line networks.

4   Imperfect Fixed-line Competition and Regulation

As noted in section 2, if there is imperfect competition in the retail market for the provision of fixed-to-mobile calls, then regulating mobile termination charges by itself is unlikely to lead to economically optimal retail pricing. While applying price regulation to mobile termination charges may reduce retail prices, there will be incomplete pass-through of any reductions in termination prices. Fixed-line carriers will 'seize' some of the gains from lower termination charges rather than passing these benefits on to end-users.

Further, as we noted in section 2, if inconsistent regulation is applied to mobile termination charges and to fixed-to-mobile prices then regulation can make the end-users worse off, not better off. We showed this for a simple price cap. If mobile termination charges are directly regulated and fixed-to-mobile prices are covered by standard price cap regulation then any reduction in mobile termination charges may make end-users worse off. The reason for this is simple. Under the price cap, any reductions in mobile termination charges are not passed onto customers through lower retail fixed-to-mobile call prices. Rather, fixed line carriers maintain retail prices at the (binding) price cap and any reduction in termination charges just leads to a wind fall profit to the fixed-line carriers. At the same time, reduced mobile termination revenues lead to rebalanced mobile service prices. From the end-users perspective, the price of mobile services such as handsets and mobile calls will rise without any offsetting gain through a fall in fixed-to-mobile call prices.

While the example presented in section 2 and summarised above is simple, it also provides a good 'first approximation' of the regulatory situation in Australia. Further, as noted in section 1, there is evidence that fixed-to-mobile call prices to households and SMEs have not fallen in line with reductions in mobile termination charges and may, in fact, have risen. This suggests that the current regulatory mix used for fixed-to-mobile calls in Australia may be harming these customers.

In this section we consider the problems of regulating fixed-to-mobile call charges with a dominant fixed-line carrier in more detail. We present and briefly discuss a number of alternative solutions that could be adopted by the regulator.

4.1   The price of fixed-to-mobile calls

Before considering the interaction between price cap regulation and mobile termination charging in more detail, it is worth considering the nature of the regulation applied to the fixed-line carrier. As discussed above, in the presence of a dominant fixed-line carrier, even if mobile termination charges are set equal to marginal cost, this does not mean that the retail fixed-to-mobile call price will be set at a competitive level. In fact, the retail price will be set at a monopoly level if the fixed-line carrier is not also regulated.

The basic problem is that, if there is a dominant fixed-line carrier then regulating mobile termination charges does not have any affect on the market power of the fixed-line carrier. In this sense, regulating mobile termination charges only solves half the problem.

In Australia, the retail price of fixed-to-mobile calls forms part of the bundle of services that are price capped for Telstra. Such an approach to regulation however is, at best, opaque. The price cap covers a jointly produced service (a fixed-to-mobile call) and treats that call as a single vertical product. The cost of a fixed-to-mobile call involves fixed-line origination costs, carriage costs and mobile termination costs. If there is a price cap on fixed-to-mobile call prices and regulation on mobile termination charges then this effectively means that there is a fixed margin to be recovered from fixed-line origination and carriage services. But this recovery is 'hidden' within the two regulatory approaches.

To see this, suppose for the moment that the fixed line carrier does not also own a mobile carrier. The fixed line carrier is able to take the margin between the regulated termination charge and the capped retail fixed-to-mobile price. In fact, given the regulated retail price is below the monopoly price, it will always just be profit maximising for the fixed-line carrier to just meet the price cap. But the share of the capped price going to each carrier is not clear from the perspective of customers and such an approach provides little incentive for any mobile carrier to act in an innovative fashion with regards to call termination.

One obvious way to improve the transparency of the price regulation is to recognise that there are in fact two separate services that are used to provide a fixed-to-mobile call and that separate regulation might be needed for each of these two services. Rather than having one regulation covering an input to fixed-to-mobile calls and another regulation covering the price of the entire fixed-to-mobile call, it might be simpler and clearer to apply regulation to each input. Thus, there would be regulation of fixed-to-mobile call prices combined

with regulation of any fixed line charges associated with a fixed-to-mobile call.

Such an alternative approach to regulation might involve direct termination charging. In other words, the retail price of a fixed-to-mobile call would be broken explicitly into a fixed line charge and a mobile termination charge for billing purposes. This structural change was discussed above. It would clarify to both the customers and the regulator exactly what charges were being set by each carrier.

At a minimum, the ACCC could just require direct termination charging in addition to the current regulation of mobile termination charges and the Telstra price cap. Such a 'minimal' approach would provide benefits. For example, the use of direct termination charging would allow the regulator to check for consistency across regulatory regimes. PSTN originating access is a declared service and the ACCC has established pricing guidelines for this service. But essentially the gap between the capped retail price for fixed-to-mobile calls and the mobile termination price is a payment for fixed line origination services. Direct charging allows the ACCC to check that this charging is in line with efficient pricing principles. For example, if the margin available for the fixed line carrier was below the efficient PSTN originating charge then this suggests that the price cap placed on fixed-to-mobile calls is too tight, preventing the fixed line carrier from making a reasonable return. In contrast, if the margin to the fixed-line carrier exceeds an efficient PSTN originating charge then this suggests that the price cap is too loose, enabling the fixed-line carrier to retain monopoly profits.

The introduction of direct termination charging reflects the complementary nature of fixed and mobile services, creates clear transparency benefits and allows for regulatory consistency. However, the ACCC could take this one step further. Essentially, having a price cap on retail fixed-to-mobile calls makes little sense for Telstra. After all, Telstra does not control the costs of such a call because it does not control mobile termination charges. A better approach might be to explicitly include PSTN origination services for fixed-to-mobile calls in the price cap. The ACCC could recommend such a reform to the government along with direct termination billing in order to improve the operation of the price cap and to allow for transparent competition in fixed-to-mobile calls.

Under such an approach, a customer's bill for a fixed-to-mobile call would involve two components – the mobile termination charge covered by regulation and the fixed-line origination charge which in Telstra's case would fall under the price cap. This approach is relatively simple. It merely requires a modest change to billing and a redefinition of the service included in Telstra's price cap bundle. It is

clear, in the sense that the different regulated prices are easily observed by both the regulator and customers. Further, it immediately solves the price cap problems associated with reductions in mobile termination charges. Any reduction in mobile termination charges would be directly and immediately passed onto customers as these customers are billed directly for termination. There would be no possibility that the regulated fixed-line carrier could seize these reductions as a windfall profit gain. As such it overcomes the significant problems associated with the current price cap regime.

Finally, it would be possible to alter the service included in Telstra's price cap without requiring direct termination charging. Under this approach, there would be no change to customer billing. But rather than fixed-to-mobile calls being included in Telstra's price cap bundle, the fixed-line origination services used for fixed-to-mobile calls would be included in the price cap bundle. After all, it is these services that are actually provided by Telstra. To confirm that the price cap was being complied with, Telstra would need to report the prices that it charges for fixed-to-mobile calls net of the mobile termination charges (together with relevant call volumes) to the regulator. For Telstra fixed-line to Telstra mobile calls, the regulator could use the mobile termination charges that Telstra sets for other carriers when determining the fixed-line element of the call price. Again, a significant benefit of this approach is that it guarantees that the regulation provides benefits to end-users, unlike the current regulatory mix which may make end-users worse off.

4.2   Pass through

As noted in the introduction, retail prices of fixed to mobile calls do not seem to have tracked reductions in mobile termination charges. This is unsurprising. Even an unregulated monopoly fixed-line operator will not fully pass through any reduction in mobile termination charges to fixed-line customers, although there will be partial pass through. As noted in section 2, in Australia, where retail fixed-to-mobile calls come under a price cap, Telstra has no incentive to pass any reduction in termination charges through to retail customers. As Macquarie Research Equities notes, any reduction in mobile termination charges will simply 'stay with Telstra' as it prices up to its price cap.

There are a number of ways to try and overcome the existing failure of pass through. One way would be to adopt the direct termination charging discussed above. At a minimum, this makes any failure of pass through explicit by requiring Telstra to explicitly break down the

retail price of a fixed-to-mobile call into a termination charge and a fixed-line charge. If the termination charge falls and this is not passed through to the end-user then this will be obvious from the billing. The fall in the mobile termination charge will be associated with a rise in the Telstra fixed-line charge. In this sense, direct termination billing will create strong customer pressure on Telstra to pass through any reductions in mobile termination charges to customers.

As noted above, pass through of reductions in mobile termination charges to end users could also be achieved by modifying the price cap. As noted above, this could be achieved by applying the cap to Telstra's origination services for fixed-to-mobile calls rather than applying to the retail price of these calls.

Alternatively, the ACCC could recognize that there is already implicit regulation of PSTN origination charges and that the fixed-line service provided by Telstra when transiting a fixed-to-mobile call from an end-user to a point of interconnection is simply a PSTN originating service. The ACCC has established guidelines and benchmarks for fixed-line PSTN originating services and it could apply these approaches to fixed-to-mobile calls. Thus, the price of a fixed-to-mobile call would be the PSTN origination price for the call together with the mobile termination charge (including any additional fixed-line carriage).

There are a number of benefits of such an approach. First, it is simple and provides direct regulatory consistency. In fact, if there were strong competition between fixed-line providers for the provision of fixed-to-mobile calls, we would expect this price to already be the competitive market price for fixed-to-mobile calls. Second, it guarantees that Telstra receives the same price when it provides the same origination service, regardless of whether it provides that service to itself or to another carrier or whether the service is used for fixed-to-mobile calls or some other call. Third, it prevents any abuse of market power while making sure that Telstra receives a return consistent with an efficient fixed-line operator.

Again, the requirement that Telstra charge consistently for PSTN originating services could be combined with direct termination charging to provide clarity to customers.

A third approach would involve placing fixed-to-mobile calls under a separate subcap. To ensure that reductions in mobile termination charges were passed through to end users and not simply seized as windfall profits to Telstra, the subcap should be based on CPI-X-T, where T reflects the reduction in the regulated termination charge. Thus if mobile termination charges fell by, say, one cent per minute,

this would immediately feed into a reduction in the subcap on fixed-to-mobile calls of one cent per minute.

Such an approach is consistent with a variety of price caps that have been used in Australia and elsewhere. When a firm subject to price cap regulation has a significant input and this input has a well-defined price that is exogenous to the regulated firm, then the price cap will often automatically adjust for this input. For example, suppose that a gas retailer is subject to a price cap. The cap may include an automatic adjustment based on a relevant wholesale index of gas prices. This protects both the gas retailer and consumers. Much of the retail price of gas is the wholesale cost of gas. If wholesale gas prices suddenly rose, but the regulated retailer could not pass through this cost rise, then it could go bankrupt. If the wholesale price of gas suddenly falls then the adjustment guarantees that the reduced price is passed through to consumers and not kept by the retailer as a windfall profit.

Having a subcap for fixed-to-mobile prices that automatically adjusted for changes in the (regulated) price of mobile termination would be simple to introduce, would overcome the problems of pass through and would be consistent with best practice price cap regulation.

Alternatively, an automatic adjustment mechanism could be added to the existing price cap facing Telstra. Thus, the bundled price cap would be based on CPI-X-T_A where T_A would be an adjusted measure of the reduction in mobile termination charges. The adjustment would be based on the share of fixed-to-mobile calls in the regulated basket.

Adjusting the existing price cap would be slightly more complex than introducing a subcap because of the requirement to work out the relevant adjustment factor when the cap applies over a range of products. Thus, a one percent fall in termination revenues would not reduce the price cap by one percent because fixed-to-mobile calls would only make up a fraction of the revenues covered by the price cap.

Further, adjusting the existing price cap would not guarantee pass through. While a reduction in mobile termination charges would tighten Telstra's price cap, Telstra could respond to this by lowering the price of any product or products covered by the cap. For example, it may reduce the price of local calls or long distance calls as the cap tightens rather than just reducing fixed-to-mobile call prices.

This said including a termination adjustment to the existing price cap is almost certainly better for end-users than not including this adjustment. As noted above, by not having an adjustment, any

reduction in mobile termination charges makes end-users worse off as Telstra does not need to reduce any price but the price of mobile services rises. With an adjustment included in the price cap, consumers will definitely face lower prices on some telecommunications services when mobile termination charges are reduced.[32]

Finally, it should be noted that the current failure of pass through is more than simply an issue of equity and transfers. It involves a real deadweight loss to the degree that it retains overpriced fixed-to-mobile calls. It also provides poor incentives for mobile carriers to invest in innovations on termination services. Any innovation in these services that potentially leads to gains for customers in terms of lower prices may be short-circuited by Telstra. Telstra has no requirement and certainly little incentive to pass any savings on to retail customers under the price cap regime. The one exception to this holds for Telstra's own mobile carrier and we consider this below.

4.3　　Integration and bundling

As we discussed above, an integrated fixed-line and mobile carrier has incentives to distort competition. Most obviously, the integrated carrier will seek to set discriminatory fixed-line termination charges. If the fixed-line carrier can raise the termination charges paid by other mobile carriers for mobile-to-fixed calls, then it can improve the competitive position of its own carrier.

So long as PSTN termination charges are relatively uniform *and* are set to reflect the marginal cost of termination services, such anti-competitive discrimination cannot occur. However, it is not clear that PSTN termination charges are set at marginal cost in Australia. Evidence to support this would be where the retail price that Telstra offers to its own mobile customers when they call a Telstra fixed line phone are below the prices charged by other mobile carriers.

Integration may create other possible avenues for the fixed line carrier to abuse its market power. As noted above, for some customers, such as a single firm or a household, customer ignorance need not hold. Rather, if employees of one firm use their mobile phones to call other employees of the same firm and vice versa, then the firm knows that

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[32] Another approach that the ACCC could consider is the use of a universal price cap (Laffont and Tirole, 2000) which includes both the origination service and the fixed-to-line retail calls provided by Telstra.

many of its fixed-to-mobile calls and mobile-to-fixed calls will be to a particular mobile network used by the firm.

The integrated carrier has the ability to use its market power to gain these customers through a bundled fixed-line and mobile package. In particular, if the fixed line company offers discounts to such customers when they call the integrated mobile phone company (and vice versa), then the fixed line company can offer deals that cannot be matched by other mobile firms. Such discriminatory pricing can make it difficult for a mobile phone company that does not own a fixed line network to compete with an integrated company.

Elsewhere we have discussed the competitive issues relating to bundling in detail (see Gans and King, 2002b). We have also discussed the use of imputation rules to check the competitive validity of bundled products. However, the behaviour in this circumstance is harder to police because there is not a well defined access product that is used for fixed-to-mobile calls. As already noted, there is a price cap on the retail price of these calls, but there is nothing to stop Telstra charging below this cap for its bundled products and corporate clients. However, such discounting, in effect, is equivalent to Telstra setting one PSTN originating charge for its own calls and charging a different PSTN originating charge to other mobile carriers.

Carrier pre-selection should help prevent such bundling that artificially favours the dominant fixed line carrier. However, if concerns about such bundling still exist then they can again be addressed by requiring Telstra to separate out its billing and to state an explicit fixed line charge for fixed-to-mobile calls. The regulator could then use this billed charge to ensure that Telstra did not artificially favour its own mobile carrier over competing carriers in a way that was not cost justified.

4.4   Summary

In this section, we have briefly considered the effects of mobile termination charging when there is a dominant fixed-line carrier. We have considered the current price cap regime that exits in Australia and note (a) that it provides little incentive for the fixed line carrier to pass through reductions in mobile termination charges to end-users; and (b) that the current regime means that a reduction in mobile termination charges may actually harm end-users of telecommunications services.

We have noted that the underlying cause of this problem is the failure to isolate the exact service provided by fixed-line carriers in the regulatory process. We suggest a number of ways that this can be addressed. For example, direct termination charging can be used to improve transparency of regulation and pricing. This may be combined with a revised price cap regulation. For example, rather than having a price cap on fixed-to-mobile services the cap could just apply to fixed-line origination services. We note that there is already a relevant benchmark for pricing PSTN origination services and that this benchmark could be used. Alternatively, the price cap regulation could be improved by including a mechanism to directly pass through reductions in mobile termination charges. This could involve either a fixed-to-mobile subcap or the current price cap.

5   Conclusion

In this report, we have considered a variety of issues relating to mobile termination charging. A consistent message from the academic research is that there are potential problems with market power in mobile termination services and regulation to lower the price of these services is desirable. We considered both structural and direct price regulation that could be appropriate. These approaches are not mutually inconsistent – for example carrier identification and/or direct termination charging can be introduced alone or in conjunction with price regulation.

We provide a number of principles for direct price regulation that have developed in the academic literature. In particular, we note that the investment issues generally associated with marginal cost pricing are less relevant for mobile services. Thus, price regulation based on marginal cost with little if any allocation of common costs appears to be an appropriate starting point for price regulation. This differs significantly from the ACCC's current approach.

We suggest that an alternative way for the ACCC to approach price regulation is to note the long term convergence of mobile and fixed-line telephone services towards network-on-network competition. Such competition suggests that reciprocal termination charges are appropriate and we suggest a mechanism by which the ACCC might reduce mobile termination charges over time to bring them into line with fixed-line termination charges.

We note however that the price cap regulation on Telstra might tend to mute any mobile termination regulation. In particular, Telstra will price up to the cap and will simply retain any reductions in termination charges as profit. In these circumstances additional reform is needed. We present a number of alternative ways to help overcome the problem of existing regulation and to guarantee pass through to end users.

6   Appendix

We use a model with strong (Bertrand homogeneous product) competition to illustrate our result that when customers are not ignorant and mobile subscribers care about incoming calls, competition does not force termination charges down to a socially efficient level. This model has the strongest possible degree of network competition. Further, as others such as Hausman have questioned whether non-linear or linear tariffs are appropriate for various mobile charges, we show that the result does not depend on the nature of the charges. We consider both non-linear charges and the situation where only uniform prices can be charged. In each case, termination charges under competition are set above socially optimal levels.

6.1   Non-linear pricing

Take a simple model of mobile network subscriber competition. There are two networks that compete for subscribers. We will consider a representative subscriber who values outgoing calls *and* incoming fixed-to-mobile calls as well as the amount that they pay for mobile services. In particular, given a zero price for receiving calls (i.e., the caller pays for fixed-to-mobile calls) the subscribers' utility is given by

$$\int_{p_o}^{\infty} q_o(p_o)dp + v(q_t) - F \,,$$

where p_o is the price per outgoing call, $q_o(p_o)$ is the (representative) subscribers inverse demand for outgoing calls, q_t is the quantity of fixed-to-mobile calls received by the subscriber, $v(q_t)$ is the utility value of those calls to the subscriber and F is any fixed subscription fees paid by the subscriber. We can think of the subscriber as having a quasi-linear utility function so that there are no income effects associated with changing p_o. Also note that q_t is not a direct choice variable for the subscriber but reflects decisions made by fixed line customers.

The mobile networks provide an identical product so that the representative consumer will simply join the network that offers them

the greatest personal utility.[33] Total social surplus from the subscriber's decision, however, is given by

$$\int_{p_t}^{\infty} q_t(p_t) dp_t + \int_{p_o}^{\infty} q_o(p_o) dp_o + v(q_t) + (p_t - c_t) q_t + (p_o - c_o) q_o - \Gamma \quad (1)$$

For convenience, we assume that the receivers of mobile originating calls receive no utility from those calls, and use c_t and c_o to refer to the total (constant) marginal cost of fixed-to-mobile and mobile-originating calls respectively. The fixed subscriber charge F is a transfer and so is eliminated from the above equation and Γ refers to the relevant mobile network fixed costs.

From (1), the socially optimal prices are given by $p_o^* = c_o$ and $p_t^* = c_t - \frac{\partial v}{\partial q_t}$. Note that the socially optimal price of mobile-originating calls is simply equal to marginal cost. This reflects our assumption that there is no utility benefit generated by receiving such a call. But the socially optimal price for fixed-to-mobile calls is *below* marginal cost. This reflects the positive externality created by a fixed-line customer ringing a mobile subscriber under the assumption that the mobile subscriber gains utility from receiving calls. Finally, note that the zero profit constraint for the mobile carrier at the social optimum is that $F \geq \Gamma + (c_t - p_t^*) q(p_t^*)$ under the assumption that all pricing below marginal cost for fixed-to-mobile calls is reflected just in mobile termination charges.

Will competition between mobile networks lead to these socially optimal prices? The answer is that it will not whenever it is socially optimal to have a positive number of fixed-to-mobile calls. To see this, suppose that the mobile carriers are perfect substitutes, so that the representative subscriber will simply join the network with charges that maximize their personal surplus, subject to the network not operating at a loss. For convenience, assume that all non-mobile carrier elements are set at marginal cost so that there is no 'double marginalisation' with the fixed-line carrier. Then the competitive equilibrium prices will solve

$$\max_{p_o, p_t, F} \int_{p_o}^{\infty} q_o(p_o) dp + v(q_t) - F$$

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[33] In Gans and King (1999a) we used a differentiated Bertrand model with a weaker degree of mobile competition than that here.

$$\text{subject to } \left(p_o - c_o \right) q_o + \left(p_t - c_t \right) q_t + F - \Gamma \geq 0$$

The first order conditions from this problem give the competitive charges as $p_o^e = c_o$, $\left[p_t^e - c_t + \frac{\partial v}{\partial q_t} \right] \frac{\partial q_t}{\partial p_t^e} + q_t = 0$ with the fixed fee F just set so that the mobile carrier's profits equal zero. The superscript e simply represents that the above equations define a competitive equilibrium. We will assume for the present that the equilibrium fixed fee does not drive the mobile customer away from subscribing to either network.

While competition will lead to socially optimal pricing for mobile-originating calls under our assumptions, it will not in general lead to socially optimal prices for fixed-to-mobile calls. In fact, competition only leads to socially optimal prices in the trivial case where it is socially desirable to have no fixed-to-mobile calls. This is easily seen by substituting the socially optimal price into the equation for the competitive equilibrium price. Whenever there are any fixed-to-mobile calls, the competitive price will be higher than the socially optimal price $p_t^e > p_t^*$. The reason for this is simple. If a mobile provider raises the price of fixed-to-mobile calls above the socially optimal level, then this causes a loss of surplus to both the mobile subscriber and the fixed-line customer. But it also raises mobile termination revenues. While these revenues are less than the total loss of surplus, they are greater than the loss of surplus to the mobile subscriber. So if the mobile company passes these termination revenues back to the subscriber through a reduced fixed charge, then the mobile subscriber is strictly better off. Competition will drive the mobile companies to maximise subscriber utility, so they will raise termination prices above the socially optimal level.

6.2   Uniform Pricing

Put simply, competition maximises the mobile subscriber's utility and ignores any external effects on fixed-line customers. The above analysis considered two-part tariffs. Some of the submissions note that two-part tariffs or other non-linear prices may have limited practical relevance, perhaps due to differences in subscriber willingness-to-pay for mobile services. In the extreme, competition may only involve linear (uniform) pricing. If we maximise social surplus, subject to the constraint of uniform pricing for calls then we

obtain the standard Ramsey price formula for mobile-originating calls, but a modified rule for fixed-to-mobile calls:[34]

$$\frac{p_o^* - c_o}{p_o^*} = -\frac{\frac{\lambda}{1+\lambda}}{\varepsilon_o} \quad \text{and} \quad \frac{p_t^* - c_t}{p_t^*} = -\frac{\frac{\lambda}{1+\lambda}}{\varepsilon_t} - \frac{\frac{\partial v}{\partial q_t}}{1+\lambda}$$

where ε_i refers to the own price elasticity of demand for product i and λ is the relevant multiplier. Notice that because the mobile subscriber values receiving mobile calls, that the optimal uniform price for fixed-to-mobile calls is lower than under standard Ramsey pricing.

If we consider the equilibrium prices under competition, by maximising subscriber surplus subject to the mobile operators' zero profit constraint, we obtain:

$$\frac{p_o^e - c_o}{p_o^e} = -\frac{\frac{1+\mu}{\mu}}{\varepsilon_o} \quad \text{and} \quad \frac{p_t^e - c_t}{p_t^e} = -\frac{1}{\varepsilon_t} - \frac{1}{|\mu|}\frac{\partial v}{\partial q_t}$$

Note that, unlike the socially optimal Ramsey price for fixed-to-mobile calls, the competitive equilibrium price is set at the monopoly level with a mark down for the value of calls to the mobile subscriber. It is again easy to see that competition will not drive prices to the socially optimal level. Thus, if the competitive equilibrium price of originating calls is set to the optimal Ramsey price (so that $\mu = -(1+\lambda)$) then the competitive price for terminating calls is strictly higher than the optimal Ramsey price. In general competition will result in mobile originating charges that are too low compared to the socially optimal prices and terminating charges that are too high. The subscriber's gain from a decrease in originating charges compared to the socially optimal price more than offsets the subscriber's loss from receiving fewer calls. Put simply, under competition, fixed-to-mobile calls bear too great a share of the fixed mobile network costs from a social perspective.

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[34]   Note that we have assumed independent demands. The formula is easily adapted to allow for interdependent demands

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