An Evaluation of Regulatory Pricing Options for Mobile Termination Services

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Executive Summary

This paper reviews recent research into the determinants of prices and inter-network charges in relation to call termination. Its particular focus is the pricing of fixed to mobile calls and its interaction with competitive conditions in mobile communications.

That research demonstrates that mobile termination service pricing and demand is substantially influenced by patterns of mobile competition, integration among different modes of telecommunication and consumer's difficulties in distinguishing among alternative mobile carriers when placing calls. These economic factors mean that market power is present and likely to be exercised in determining inter-network call charges to the detriment of end users and overall social value created.

These factors drive recommendations for pricing methodologies used to regulate termination charges. While unregulated termination charges for calls from competing mobile networks are likely to be negotiated to low levels in the absence of regulation, those for calls from fixed networks are likely to be inefficiently high. So high in fact that fixed to mobile call prices are likely to be above levels even an integrated monopolist would charge. Consequently, lowering termination charges is likely to raise both consumer surplus and industry profit.

An appropriate benchmark for regulation is to set termination charges equal to marginal termination cost. This has the benefit of eliminating distortions that arise as market power in termination services are used to impact on competition in other areas; in particular, mobile subscription rates. However, such regulation will not result in competitive prices for fixed to mobile calls so long as there is a lack of fixed line competition. Nonetheless, so long as regulation is symmetric across mobile carriers, the level of the regulated price is irrelevant for those networks' equilibrium short-run profits. Consequently, regulation of mobile termination will not impact on incentives to invest or enter in the industry.

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1 Background

The Australian Competition and Consumer Commission (ACCC) has recently deemed as declared the originating and terminating access services provided by mobile GSM networks in Australia. This potentially means that the prices of such services will be regulated. The purpose of this paper is to evaluate potential pricing methodologies for these access services with a view to their impact on competition in telecommunications and the overall efficiency of the industry. The conclusions of this paper draw upon recent research into the determinants of inter-network pricing in the context of mobile network competition.[1] The discussion here will, therefore, be non-technical in nature and readers are referred to the technical references throughout for more details.

It is useful to begin by describing the role of access or interconnect services in telecommunications in more detail. As part of general principles of interconnection or any-to-any connectivity, telecommunications networks offer terminating services for calls originating off other networks. These services ensure that callers from other networks can reach those on a given telecommunication network and hence, are an essential ingredient in ensuring that telecommunications networks remain compatible. Given the convention that the caller pay the originating network directly, the terminating service involves the originating carrier paying the terminating carrier for that service. It is the determination of such inter-network (termination) charges that is the focus of this paper.[2]

To be clear, a terminating service is essentially the carriage of a call from a point of interconnection between two networks to the consumer for whom the call is intended. Thus, the terminating network bears the trunk and connection costs from that point of interconnect to the consumer while the originating network bears the costs from the

[1] See, in particular, Gans and King (1999a). Portions of this paper are reproduced there.

[2] Where the B-party does pay for a call (such as for 1-800 and similar services), the appropriate focus is on the origination service. The discussion here focuses on termination but as will be explained below, it applies equally to origination as well.

caller to the point of interconnect. Under the caller-pays principle of charging, however, the caller is charged for both the originating and terminating services. The originating network collects the call charge and that network and the terminating network must, in turn, transact for the terminating service. It is the price that the terminating network charges the originating one that is the focus of the present analysis. Not surprisingly, as that price becomes part of the marginal cost of the call service, it also an important factor in determining the overall price of the call.

The principal focus here is on termination charges that arise for calls made from fixed line to mobile networks. These termination charges are set by mobile networks while the ultimate price of fixed to mobile calls is set by the fixed line network. A regulatory concern arises because of a potential lack of competition on either end of this service. First, fixed line networks – particularly on the local loop – are still effective monopolies in many jurisdictions, including Australia. Hence, those networks are able to exercise considerable market power in the pricing of all their services.[3] Second, once a mobile network has attracted a consumer, it in effect owns the termination revenues that might flow to that consumer. This potentially gives it market power in the setting of termination charges for access to its consumers.

It is with this in mind that the regulation of termination charges is considered. In the next section, the case for price regulation of termination services is reviewed with particular attention paid to the factors underlying that case. In section 3, the implications of possible regulated pricing methodologies are examined. This examination is conducted with a view to the impact on other prices that are part of mobile communications (e.g., call and subscription rates) and also to the potential entry and investment implications. A final section offers concluding remarks.

[3] In Australia, fixed-to-mobile call prices are now set by long distance carriers rather than the local network owner. Nonetheless, as will be discussed below that this distinction is in many ways cosmetic.

2 The Need for the Regulation of Termination Services

The first task is to review the case underlying the need for the regulation of termination services. In short, without such regulation, inefficiently high prices may result. This potential undesirable outcome arises because of the economic factors that determine how firms will set mobile termination charges. There are essentially five key characteristics of terminating services that drive their value and use. These are: (1) market power over access to a consumer; (2) consumer ignorance regarding the network called; (3) horizontal separation; (4) vertical separation; and (5) tariff-mediated network externalities. Each of these combines to limit the potential for competition to drive termination charges to socially efficient levels.

A distinction must be made, however, between termination services given to calls from a fixed line network and those from other mobile networks. This is because the competitive interactions are more intense in the latter than the former case. This means that there are subtle differences in the case for regulation of each. Hence, after reviewing the economic characteristics of termination, the need for regulation of termination of calls originating on mobile and fixed line networks respectively are considered.

2.1 Market Power Over Access to a Consumer

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 which company will supply 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. Because of this, 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 so that some family members can use fixed to mobile calls to contact other family members. The person choosing the network will then tend to be equally concerned about incoming and outgoing call charges.

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.

2.2 Consumer Ignorance Regarding Inter-Network Pricing

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 phone system. 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, 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. Such a customer will not know the cost of their call in advance but can only use an estimated price based on market shares.[4]

This effect is exacerbated in the context of number portability. Even where a prefix may have given some information regarding the

[4] 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).

network being called, with mobile number portability those differences will diminish in the future and make networks indistinguishable to the consumer.

To see the effect of this uncertainty, suppose that the opposite were true and a customer calling fixed-to-mobile both knows 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 termination charges. This will, in turn, make the plumber indirectly face the termination costs – if they join a mobile network with high termination charges then they will receive fewer calls and less business. A mobile network with higher termination charges will have fewer members and competition will tend to moderate termination charges.

In contrast, suppose that the person making the fixed-to-mobile call is only able to guess at the identity of the terminating network. In particular, suppose that the A-party only knows the market shares of mobile carriers and there is a price differential between calls to respective networks. Then the caller only responses 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. This is 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,' as referred to as *customer ignorance.*

2.3 Horizontal Separation

There are three further effects that exacerbate the concerns about termination charges. One of these flows from customer ignorance, and can be referred to as *horizontal separation.* As noted above, 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* such calls as they cannot identify the carrier 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 horizontal separation to result in excessive mobile termination charges.

2.4 Vertical Separation

Mobile termination charges are also likely to be inflated due to *vertical separation.* This effect is well known in economics. 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 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 degree 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 carrier. As a result, termination charges tend to be marked up over cost twice – once by the GSM carrier and once by the fixed carrier. In the extreme, this can lead to pricing above the vertically integrated monopoly price.

A similar effect may occur for termination charges set between competing mobile networks. To the extent that those networks sell somewhat differentiated products, in the absence of a negotiated outcome, each has an incentive to set termination charges above marginal cost and introduce a second mark-up. This too can result in inter-network call charges above monopoly pricing levels.

2.5 Tariff-Mediated Network Externalities

Finally, termination charges might not reflect competitive behaviour because of *network externalities* between mobile 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.

If mobile phone charges were cost reflective then it is not clear that there would be any network externality. But mobile carriers might have an incentive to use termination charges to create these externalities. For example, if a dominant mobile carrier wanted to stifle

competition from a new entrant, it could set high call 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. 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 network.

To be sure, this in part depends on customer's knowledge of call price differentials. However, even with customer ignorance of these, a higher termination charge will raise the costs of a small network considerably. This may undermine its ability to compete effectively.

2.6 Termination of Fixed-to-Mobile Calls

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. But 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 the mobile network. However, this effect is limited by customer ignorance. What this means is that if a given mobile network raises its termination charge this will influence the average number (or length) of fixed to mobile calls to all networks and will not cause that network to receive proportionately fewer calls than other mobile networks. This is because callers to mobile networks respond only to the overall price of fixed to mobile calls and cannot distinguish any price differentials in such calls to alternative mobile networks.

This means that unregulated mobile termination charges will 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. 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. The end result is what is referred to as 'double marginalisation.'[5] As the mobile network raises the fixed network's marginal cost of fixed to mobile calls, the price of those calls is higher. This results in lower consumption, reduced consumer surplus and also in 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 setting the same fixed to mobile call charge regardless of the network being called. This call price will be set on the average termination charges. Consequently, an increase in one mobile network's termination charge will raise this average and the fixed to mobile price in general and not simply to its own network. Thus, an increase in its termination charge has a negative external effect on the termination profits 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.

Indeed, 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

[5] For a discussion see King and Maddock (1996), Chapter 4.

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.[6] 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. One mobile network may receive a higher termination charge for calls made from its network to the fixed network. This would leave it in a diminished competitive position and hence, price competition among the networks would be weakened. This, in turn, would allow for a fixed-to-mobile service to have lower prices as the favoured network would have less pressure to raise its termination charge. 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.[7]

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[6] See Gans and King (1999a), Section 4.

[7] It should be noted that the possibility of integration between the fixed network and one mobile network does not improve these outcomes. While such integration will reduce the average termination charge (as the integrated firm sets its implicit termination charge equal to marginal cost), this will cause the non-integrated mobile carriers to raise their termination charges accordingly. The end result is that the integrated carrier will receive a lower level of profits than if it was vertically separated. Hence, integration 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.

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.

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 fixed-to-mobile 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.

2.7 Termination of Mobile-to-Mobile Calls

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.[8]

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, 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 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 unchanged.[9] In this respect, networks would not be deterred from negotiating termination charges equal to marginal termination cost and, provided negotiations are efficient,[10] unregulated outcomes will result in efficient pricing.

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

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

[10] This means that negotiations must actually take place; there must be no significant information asymmetries and also, no other distortions that might arise from regulatory concerns.

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.[11]

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 may be set too low, resulting in a softening of mobile network price competition.

Essentially, mobile termination charges for calls from mobile networks may be set lower as mobile networks recognise their competitive interdependence and the ability of those charges to manipulate the terms of price competition. This stands in contrast to mobile termination charges for calls from fixed networks that do not directly influence mobile price competition. The effect of those termination charges is indirect and hence, the incentive is for those charges to be set as high as possible to minimise those indirect effects. Thus, established mobile networks will have incentives to reach agreement over termination charges for mobile-to-mobile calls but for fixed-to-mobile termination mobile networks may have a reduced incentive to negotiate. It is, therefore, likely that termination disputes will arise as

[11] See Gans and King (1999b).

fixed line networks (or new mobile entrants) attempt to negotiate lower charges rather than because of issues between competing mobile networks.

2.8 Termination Charges and Access Pricing Issues

Given the above, it is worth reflecting upon 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 highlighted above 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 those monopolistic conditions and pricing downstream. Specifically, they might price in such a way that few firms are able to operate downstream. In this situation, the role of regulation is to facilitate downstream competition that might otherwise be harmed by discriminatory access pricing.

There is also a concern that termination charges could be used to either make entry difficult or raise rival's costs; thereby, harming competition in a related market. But in this case, the monopolistic conditions arise because of network effects. Termination services arise when networks interconnect with one another. As interconnection subdues the monopolistic tendencies of network effects while preserving their (demand-side) benefits, the issue of foreclosure is only salient when considering interconnection terms to 'smaller' players. Termination charges may be used in the same way as discriminatory access charges to raise rivals costs. On the one hand, this may lead to a reduction in network competition by making entry difficult. On the other, it may lead to a softening of price competition between established networks.[12]

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

But there is also the fact that there may simply be insufficient competition in certain inter-network services that is of concern to regulators when considering termination charges. That is, so long as there is customer ignorance, the termination service itself cannot be a locus of network competition. Indeed, because of this it can potentially be used as a means of cross-subsidising competition on main network services. Hence, the regulator is faced with difficult questions regarding the balance of prices among different network services, including termination services and cannot simply consider one without examining the consequences for others.

3 Pricing Options

Having reviewed the potential for inefficient pricing outcomes for termination services, this section now reviews the appropriate pricing methodology that might be applied to regulate such services. Attention will be confined to the issue of mobile termination charges for calls from fixed line networks. For calls from other mobile networks, it is likely that once established networks are compelled to provide access at reasonable terms, both networks will have shared incentives for lower termination charges that are likely to differ from regulated outcomes. That is, any regulated pricing outcome is unlikely to be binding for mobile-to-mobile calls. As such, these will not be the focus of the discussion to follow.

This section will proceed as follows. The first issue addressed will be the appropriate benchmark upon which to base prices. Secondly, the issue as to whether some accounting should be made for investment expenditures will be considered. Third, the need for symmetric regulation across mobile networks will be discussed. Fourth, the issue of mobile origination charges is reviewed. Finally, the implications of increased fixed line competition are considered.

3.1 The Appropriate Benchmark

Unregulated termination charges will lie above marginal termination cost and will result in fixed-to-mobile call prices above levels that an integrated monopolist would set them. Consequently, a regulated termination charge could be used to reduce fixed-to-mobile call prices by exerting downward pressure on the costs faced by fixed line operators setting those prices.

A key issue is, therefore, how low termination charges should be set to achieve this goal. If one were to consider fixed-to-mobile calls as a stand-alone service, social efficiency would be maximised if the prices of those calls were 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 does not stand-alone. 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 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. Let us denote this by c_T. Given the possibility of congestion, this is likely to differ between peak and off-peak times. Nonetheless, it would be possible to use the lowest mobile call prices themselves to infer something about these costs. In particular, suppose that it was known that average trunk rates for mobile calls – say over long-distance lines – was c_1 per minute. Thus, the total marginal cost of a call would be $c_1 + 2c_T$ (the latter term assuming that it costs the same to originate and terminate a call).[13] 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 $c_T = \frac{1}{2}(p - c_1)$. Hence, the upper limit on termination charges for fixed to mobile calls should be $\frac{1}{2}(p - c_1)$.

Note, however, that it is important that this not be a formulaic regulated price in the sense that it would be updated based on

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

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 price could be based on current (pre-regulation) prices. Or, alternatively, the price used could be the minimum per call minute price of any mobile carrier. While not perfect, this would diminish the incentives of individual networks to raise call prices to strategically increase termination charges, as they would be the same across networks.

In conclusion, establishing marginal termination cost as the appropriate benchmark upon which to base regulated termination charges would appear to address the primary competitive concerns that arise. First, it will prevent either fixed line or mobile carriers from utilising their market power to make entry difficult. This includes mobile-to-mobile termination as well as fixed-to-mobile termination. Second, it neutralises termination profits (or losses) as an instrument that distorts mobile call and subscription charges. This is because mobile carriers would not make positive profits from termination and hence, would not be able to use these to cross-subsidise their competitive behaviour in mobile network competition. Consequently, fixed-to-mobile calls would be charged on a similar cost basis than calls from mobile phones. This would reduce consumer distortions either towards or away from the use of mobile telephony. Indeed, when consumers expect lower fixed-to-mobile prices and value in-coming calls to some extent, such actions should facilitate mobile phone adoption rates.

3.2 Accounting for Infrastructure Investment

One objection to using marginal termination cost as the basis for regulating mobile termination would be that it makes 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 made. 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 their profits in equilibrium because other 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.[14] 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.

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 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.[15]

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

[15] See Gans and Williams (1999a, 1999b) and Gans (1998) for a discussion of efficient investment pricing. To date, there is no research on the appropriate efficient investment price for interconnection.

3.3 Comparison with 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)

In many contexts, TSLRIC (being an average cost price) is above marginal cost of a service.

In this context, however, 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.[16] 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 cost that would be avoided by not providing fixed line termination would be the marginal termination costs.

In addition, the rationale behind TSLRIC was the goal of mimicking the outcomes of a contestable market. In this respect, entry was socially desirable if the average cost of the entrant were lower than that of incumbents. Under TSLRIC access pricing an entrant would, theoretically, only find it profitable to enter if they had lower production costs than the incumbent. However, when it comes to mobile network entry, being able to make calls to and receive calls

[16] 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.

from fixed lines is essential to the total service provided. Moreover, at present, mobile networks do not directly compete with the fixed line network and hence, there would be no incentive for a non-integrated fixed line network to discourage such interconnection. As such, as the fixed and mobile services are not close substitutes, the usual cost-minimisation argument does not apply. In this context, strict application of TSLRIC may lead to termination charges that were too high and hence, reduced industry profit and diminished incentives to invest and enter the industry.

3.4 Symmetry of Regulation

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. *Regulation of any mobile carrier's termination charges can reduce fixed to mobile prices but will result in an increase in unregulated carriers' termination charges.* This is because unregulated carriers can increase their termination charges, and hence profits, while maintaining a higher quantity of fixed to mobile calls and also increasing the relative attractiveness of competing for new customers. 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.[17]

3.5 Mobile Origination Charges

Origination charges are relevant for services such as 1-800 numbers, where the B-party pays for the call. If mobile operators have fixed market shares, then these origination charges raise similar issues to termination charges. B-parties receive calls from mobiles in a ratio that (approximately) equals the market share of the mobile carrier. But each B-party does not decide on the volume of calls that it receives and, for many services, may have only a relatively slight control over the length of the call. Thus, the critical margin of choice for the B-party is whether or not to offer the service at all.

Suppose that the demand curve for 1-800 and similar services is downward sloping. If origination charges are higher, then fewer B-parties will take up the service. Also, assume that the B-party cannot select which mobile carriers can be used to call its number. Then exactly the same issues as arise in fixed-to-mobile termination charges arise for origination charges. In particular, from the B-party's perspective there is consumer ignorance in the sense that they simply receive a sample of calls from all mobile carriers and the weight of calls in the sample is (approximately) the same as the market shares of each carrier. Each mobile carrier has an incentive to overprice origination charges and these charges will be above the monopoly price whenever there is mobile carrier competition.

Given this, mobile originating charges for B-party payer calls pose the same set of issues as mobile termination charges for fixed-to-mobile calls. Thus, the goal of setting such charges equal to marginal origination cost in order to remove these as a strategic consideration would apply in this case.

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

3.6 The Role of Fixed Network Competition

The analysis above has taken place in the context where there was a monopoly or dominant fixed network, or alternatively, where fixed networks had a large degree of market power. Thus, it is sometimes argued that if there were competition among fixed networks this would assist in reducing fixed to mobile charges.

Fixed network competition will certainly reduce the margins those networks charge on fixed to mobile calls. However, these margins are above marginal costs that are based, in part, on the termination charges set by mobile networks. The incentives of those networks to keep those charges high remain even when there is fixed network competition. This is because consumers are still ignorant of the mobile network they are calling. Consequently, encouraging competition among fixed network does not reduce the case for introducing the suggested regulatory alternatives above.

An alternative that is currently being pursued in Australia is to allow customers to pre-select a carrier that will bill them for fixed to mobile calls. In the absence of any further regulation, the pre-selected firm will negotiate directly with the fixed and mobile carriers regarding the charges for fixed to mobile calls. If there is strong competition between pre-selected firms, then the negotiated charges will be passed on directly to the end users.

The use of pre-selection for fixed to mobile billing does not remove the issues of horizontal or vertical separation and, by itself, makes no change to the problem of customer ignorance. The pre-selected firm is simply an agent for the individual consumers. Nonetheless, this does change the strategic interaction between firms and can reduce fixed to mobile charges.

To the degree that there is extra regulation with pre-selection, the price of fixed to mobile charges will also change. For example, suppose that the fixed carrier is not regulated with regard to the price it can set for fixed to mobile calls, but that the charge for fixed line origination under pre-selection is regulated at a price below the profit maximising price for the fixed carrier. Then pre-selection will pass this lower price onto the customer. The lower fixed network origination charge will result in lower overall fixed to mobile prices. This will be at least partially offset by the mobile carriers raising their termination

charges. Overall, the customers and the mobile carriers will gain at the expense of the fixed carrier.

4 Conclusion

This paper has reviewed recent research into competitive behaviour in mobile phone markets with a view to informing about the trade-offs involved in regulating mobile termination charges. In so doing, it goes only as far as the academic literature has taken the analysis. Consequently, there is room for further research into (1) the measurement of marginal termination cost; (2) non-linear regulated prices; and (3) the implications for regulated interconnect on decisions to enter and invest in telecommunications infrastructure.

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