NON CONFIDENTIAL VERSION

Vodafone comments on the ERG Draft Common Position
on
Next Generation Networks Future Charging Mechanisms /
Long Term Termination Issues

10 December 2009

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Executive Summary

Vodafone welcomes the opportunity to comment on the ERG Draft Common Position (CP) dealing with interconnection pricing in next generation networks (NGN). Notwithstanding the title, the CP consists chiefly of a discussion on Bill and Keep (BaK) applied to interconnection of voice telephony.

The CP foresees a long term migration towards a fundamentally different interconnection charging regime. Under this regime existing call termination prices are replaced by a combination of mandated zero prices, and regulations to define the points of interconnection at which the zero price would be available and to prevent abuse and free riding analogous to those which currently appear in commercially negotiated peering agreements.

No NRA in the world currently mandates BaK

No NRA in the world currently mandates BaK.[1] Commercially agreed BaK does occur between certain groups of network operators in North America. But this is restricted to agreements between similar networks, with similar coverage, technology and traffic patterns, where inpayments would be expected to balance outpayments.[2] Networks in Hong Kong and Singapore also use forms of BaK, but in the context of very different urban operating environments.

Mandated BaK is not "de-regulatory"

The CP does not make a convincing case for mandated BaK. Mandated BaK is not the de-regulatory option that the ERG appears to envisage. Further, de-regulation is not in itself a justification for any particular approach over any other.

Mandated BaK creates perverse incentives to generate off-net calls, and to restrict capacity for incoming off-net calls, particularly in data intensive environments where demands on capacity will be unlike anything seen in the past. The result of these incentives is, as we will explain, that BaK will actually require additional regulation, including:

1. requirements that all operators provide "sufficient interconnection capacity for incoming calls", where a precise quantitative determination of "sufficient" interconnection capacity will need to be made by the NRA based on a scale of expected or forecast traffic levels;
2. a possible further regulatory requirement on retail prices to the effect that MNOs may not discriminate between prices for on-net and off-net calls.

These measures would represent both technically difficult and intrusive forms of regulatory intervention that would constrain competition. Mandating rules to ensure efficient network utilisation will lead NRAs into new forms of intervention. Banning flexibility to discriminate between on-net and off-net prices will blunt competition. This is not observed in other countries today because no other country operates a mandatory BaK regime in which networks must terminate all competitors' traffic irrespective of any conditions on asymmetry of traffic flows (as would normally be in place in a commercially negotiated Internet peering agreement). The consequences we describe are exacerbated as voice calls compete for network capacity and prioritisation in an increasingly contended and data centric network environment.

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[1] See Ofcom, "Wholesale mobile voice call termination, Preliminary consultation on future regulation", May 2009, paragraph 6.145.

[2] The ERG could consider a mandated BaK system that is applicable only when traffic balances are within a certain percentage tolerance (or collar), but this would necessitate regulatory mandate of both the tolerance and the rate applicable outside of the collar.

There is no empirical justification to support the economic rationale of BaK

The economic rationale for BaK rests on the claim that the benefit users gain from receiving calls is of a similar magnitude to the benefit they gain from making them (and that the benefit from receiving calls can not be internalised).[3] The CP acknowledges that there is no empirical evidence for this. In fact the whole basis for finding market power in call termination today is based on the assumption that there is no value to receiving calls. Otherwise networks would already compete on the basis of offering the lowest termination rates and there would be no interconnection "problem" to address.

There is no clear evidence that consumers are better-off in a B&K regime

The ERG also attempts to justify the CP on the basis of empirical evidence of the outcome of low termination rate regimes in the US, Singapore and Hong Kong (but not Canada) in terms of lower revenue per minute (that the ERG claims equates to prices) and higher minutes of use. The CP's use of this evidence is casual and lacks statistical rigour. Proper analysis of the data quoted by the CP does not support its conclusions. The CP's claimed superiority of BaK is supported only by the US (since Hong Kong and Singapore are incomparable city states). Since the US does not mandate BaK and its use is restricted to similar networks with symmetrical traffic, it provides no evidence on the benefits of such a regime.

Evidence from the US shows that lower termination rates result in higher prices for low users (in particular pre-pay offers with recurring monthly costs) and consequently a lower rate of market participation (in terms of the percentage of adults or households using mobile telephony).

The existing MTR regime remains appropriate in an IP environment

The ERG's concern to minimise arbitrage between existing voice services (in either circuit switched or IP based networks) and voice over the Internet is misplaced. Voice services provided by the networks under a CPNP regime can (and should) co-exist with best efforts voice provided over the Internet.

The ERG should give other alternatives full and proper consideration

Finally the ERG has ignored all other alternatives for interconnection arrangements by treating the issue as a "two horse race" between existing CPNP per minute termination rates and BaK. This is disappointing since the ERG is attempting to formulate a long term strategy and it should be possible to explore all potential options fully. Some may be superior to both BaK and existing arrangements. Vodafone believes that capacity based charging (CBC) has many advantages over BaK and we urge the ERG to give such alternatives a full and proper consideration.

Table 1 summarises Vodafone's conclusions on the respective benefits of alternative regimes for the medium term.

[3] More strictly it assumes that the distribution of the benefits equals the distribution of the network costs.

Table 1: Summary of different call termination regimes

	Existing per minute charging	CBC	BaK
Retail price flexibility	No - limited by per minute outpayments	Yes – within constraints of efficient use of network to reflect underlying capacity costs	Yes – but at cost of inefficient network use, and rebalancing of other tariffs
Efficient use of network	Yes – originators pay for termination usage	Yes – originators pay for termination capacity	No – anomalies of "free termination"
Efficient time of day use of network	No - limited to daytime, evening and weekend pricing allowed in only some countries	Yes - encourages full time of day pricing	None – no incentive whatsoever
Ensure quality of service	Yes - networks get paid for successfully terminated calls	Yes - networks get paid for terminating capacity	No – networks have incentive to restrict capacity for incoming calls. Potential connectivity breakdown
Competition	Yes - allows competitive market	Yes - allows competitive market	Uncertain – lower quality on call termination (or connectivity breakdown) may favour larger networks with more on-net calling
Unsolicited SPAM/SPIT	Limited problem (addressable with other measures)	May be problem outside of peak periods	May be problem in all time periods
Implementation costs	Moderate (i.e. existing level)	High	High
Regulatory simplicity	Existing system functions well	Risk of new system	Avoids some price setting, but risk of new system

The comparison is striking for two reasons:

- The only areas where BaK has advantages over the existing CPNP regime (retail pricing flexibility and regulatory simplicity) also entail significant drawbacks. Against this BaK has its significant drawbacks in a number of areas, generally associated with efficient use of the network and lack of incentives to preserve quality of service for call termination (leading in the extreme to connectivity breakdown).
- CBC provides either the same or greater benefits than BaK in all cases. In particular, it achieves retail price flexibility (but within the constraints of efficient use of the network to reflect underlying capacity costs), but also allows for efficient time of day price signals, which the existing CPNP regime does only partially (in some countries), and BaK will fail to do at all.

1. Introduction

Vodafone welcomes the opportunity to comment on the ERG Draft Common Position (CP) dealing with long term issues associated with interconnection pricing in next generation networks (NGN). Notwithstanding the title, the CP consists chiefly of a discussion on Bill and Keep (BaK) applied to interconnection of voice telephony.

The CP foresees a long term migration towards a fundamentally different interconnection charging regime described as BaK. Under this regime existing call termination prices are replaced by a combination of mandated zero prices and regulation to define the exact points of interconnection at which the zero price would be available, and a variety of new regulations to prevent abuse and free riding analogous to those which currently appear in commercially negotiated peering agreements.

The CP does not make a convincing case for mandated BaK.

Vodafone's response is structured as follows:

- Section 2 deals with the practical consequences of BaK. Vodafone believes that mandated BaK will have a number of consequences for network usage linked to the incentives to generate on-net and off-net calls, and provide capacity for incoming off-net calls. These consequences are not observed in other countries because no other country operates a mandatory BaK regime in which networks must terminate all competitors' traffic irrespective of any conditions on symmetry of traffic flows (as would normally be in place in a commercially negotiated Internet peering agreement);
- Section 3 questions the underlying economic rationale for BaK. Mandating a zero price can only be economically efficient under very stringent assumptions, for which there is no empirical evidence;
- Section 4 discusses failures in efficient investment that will be created by BaK. In particular it creates incentives for inefficiently large volumes of off-net unsolicited calls, places restrictions on the ability of network operators to manage time of day loads through pricing signals, and creates inefficient arbitrage opportunities;
- Section 5 discusses the distributional consequences of BaK – the rebalancing of prices between low and high users. The ERG largely ignores this issue, focusing only on the benefits of increases in the total number of voice minutes generated. At the very least, the ERG needs to consider the universal service implications of a rise in low user pre-pay tariffs;
- Section 6 deals with the transitional issues between circuit based (time division multiplexing - TDM) and packet based (IP) voice services. Although some commentators attempt to link BaK to the migration of voice services from circuit switched to packet based technology, Vodafone sees no such necessary connection. Either interconnection regime would work equally well (or badly) under either technology. Further, there is no conflict between the existing interconnection regime for the public Internet (essentially peering and paid transit) and the existing CPNP scheme for voice services (under either circuit based or packet based technologies);
- Section 7 discusses the alternative of capacity based charging (CBC);
- Annex 1 provides answers to the ERG's specific questions.

2. The CP understates implementation issues and risks with BaK

2.1 BaK requires NRAs to consider quality of service and retail price regulation

Mandated BaK allows networks to terminate traffic off-net at zero cost, and provides networks with a viable strategy to increase the costs of their competitors with retail pricing that generates off-net calls.[4] By contrast, networks will face a non-zero marginal cost for all calls terminated on-net. This will give networks a strong incentive to favour off-net call termination over on-net termination (since both incur the same origination cost).

Set against this will be the fact that whereas networks have complete control over the quality of their on-net calls (in terms of congestion etc.), they have limited (or no) control over the quality of off-net calls (since the quality of the call is determined by the quality on its weakest segment).

This leads to a clear dichotomy:

- On-net calls will be relatively more expensive but will have high quality / low congestion;
- Off-net calls will be cheaper but may suffer from lower quality / high congestion if the terminating network is not prepared to match the same quality of service.

This scenario for BaK results in a number of concerns that would need to be addressed:

First, networks will have little incentive to provide capacity for terminating calls and, unless prevented from doing so, will throttle back capacity for incoming calls at the POI. The lack of investment incentive will be more noticeable for mobile network operators since a higher proportion of the incremental cost structure is traffic sensitive. Incoming calls to mobile networks, therefore, impose a more noticeable incremental investment burden, and mobile network operators are more likely to find it advantageous to restrict incoming call capacity if they find that the benefit to their subscribers of maintaining the same quality as for outgoing calls is not justified.

The exception may be interconnection between large networks of equal size which will find it in their mutual interests to provide sufficient interconnection capacity under BaK in order to provide the same high quality for both on-net and off-net calls. This will be akin to commercially agreed BaK agreements between mobile networks in the US, or peering agreements between Tier 1 Internet backbones. However, this will only apply between networks of equal size. Smaller networks, although entitled to zero termination under mandated BaK, could still find their outbound interconnection capacity throttled.

The likely consequence of this incentive to throttle back interconnection capacity for incoming calls is that NRAs introducing mandated BaK will need also to introduce regulation requiring all operators to provide "sufficient interconnection capacity for incoming calls". The determination of "sufficient" interconnection capacity will involve NRAs in a new aspect of regulation since under the existing cost based pricing network operators do have an incentive to make provision sufficient capacity since they only receive payment for calls that are successfully terminated.

An NRA making such a determination on "sufficient" capacity would need to perform the calculations and make the judgements normally performed by network planners, balancing the cost of interconnection capacity against the judgement of an acceptable level of congestion. Statistical analysis based on erlang distributions provides only part of the answer. Equally important will be judgements of future demand and forecasts of future traffic variability. NRAs are not well equipped to make such "micro-management" determinations.

[4] We emphasise that this discussion applies only to mandated BaK. Commercially agreed BaK will display none of the features discussed in this section.

Secondly, assuming NRAs do supplement BaK with requirements for "sufficient interconnection capacity for incoming calls", network operators would then be incentivised to charge low prices for off-net calls in order to flood traffic over the interconnection links (for which sufficient capacity would have to be provided by the terminating network), and thus increase the costs of the rival terminating network. In the worst case scenario these calls would be low value telesales (or other SPAM) that provide no value to the terminating network's customers.

This might be avoided only by the NRA adding a further regulatory requirement on retail prices to the effect that MNOs may not discriminate between prices for on-net and off-net calls.

2.2 *Growth of data traffic will accentuate need to regulate*

The situation described above will be accentuated by the rapid growth in data traffic on mobile networks (generated from mobile broadband technologies such as HSPA). The expectation of many mobile network operators is that data traffic will come to dominate the utilised capacity, and networks will become primarily dimensioned to meet the busy hour load of data traffic, rather than voice. Already in the EU today, around two-thirds of mobile network capacity is used by data traffic.

A capacity contended data centric network environment of the future will have implications for how voice and data are handled within the same network. Voice and data traffic have very different service quality requirements in terms of latency caused by packet congestion in the network at the busy hour. Whereas data traffic can tolerate significant latency, the voice service can not. Voice services packets, therefore, will need to be prioritised over the network at the busy hour.

Prioritisation of originating voice calls will happen because of the higher revenue per unit of capacity that mobile network operators can earn for voice services from their subscriber base. The same will also be true for terminating voice traffic under a CPNP regime, where mobile network operators earn an MTR to cover the cost of the voice service (or voice prioritisation in a packet network). If these services were not prioritised, network operators would simply lose revenue through failed calls.

Under BaK, however, there will be no incentive to prioritise incoming voice traffic since there is no revenue benefit (unless, against empirical evidence, there is a strong call externality).

This problem with the lack of incentive to provide sufficient quality of service for incoming voice traffic under a mandated BaK regime in an IP network is, in a sense, an extension of the equivalent situation where mandated BaK will incentivise voice networks to throttle incoming capacity at the POI in a TDM network (described above). However, for a TDM network, once the incoming traffic gets past the POI it receives the same quality as all other calls on the network (since there is no way to distinguish). In a packet network, however, mixing both data and (prioritised) voice, network operators will have the ability (as well as the incentive) to de-prioritise incoming voice and let it take its chances with the rest of the data traffic. Incoming voice will receive a lower quality at the busy hour throughout the whole terminating segment on the network.

Individual network operators of equal size and with symmetric traffic balance may agree a peering arrangement where they do in fact provide quality of service to each others traffic (using SIP-I for example). For the remainder of interconnection arrangements, however, mandated BaK will need to be supplemented by quality of service regulation on the prioritisation of incoming voice traffic over data, with NRAs mandating all necessary prioritisation parameters for voice traffic.

Mandated BaK for voice traffic introduces even more regulatory issues in an IP NGN than in a traditional TDM network.

2.3 BaK will not be deregulatory

Thus, far from being deregulatory, mandated BaK will require two supplementary areas of regulation[5]:

1. a requirement that all operators provide "sufficient interconnection capacity for incoming calls", where a precise quantitative determination of "sufficient" interconnection capacity will need to be made by the NRA based on a scale of expected or forecast traffic levels;
2. a further regulatory requirement on retail prices to the effect that MNOs may not discriminate between prices for on-net and off-net calls.

We again emphasise that this outcome applies only to mandated BaK. Existing BaK agreements between networks in the US, Canada, Singapore and Hong Kong do not exhibit these characteristics since BaK exists in limited situations, either commercially agreed or between networks of similar types.

2.4 BaK results in asymmetric treatment of mobile networks

When terminating geographic calls on fixed networks the location of the terminating customer is known to the originating network and so the call can be delivered to an appropriate local POI. When terminating to a customer on a mobile network, the location is unknown to the originating network and so calls are passed to the mobile network as soon as possible (near end hand-over).[6] Mobile networks frequently have a far greater number of POIs for outgoing calls than for incoming calls for this reason. ✂ This implies that mobile networks will be required to offer BaK from any POI and suffer themselves any national transport costs (in contrast to fixed networks). In effect the majority of mobile call costs (including the entire transit and mobility component) will be borne by the receiving customer. This contrasts with the outcome of BaK for termination on fixed networks where the majority of the cost (including transit) is borne by the originating network.

This asymmetry in division of the cost of a call to a mobile network is economically rational only if the majority of the benefit of a mobile call is to the call receiver (and a minority to the originator); whilst for a call to a fixed network the reverse is the case. Yet there is no reason why the distribution of benefits between caller and receiver should be distributed in favour of the caller for a fixed terminated call, and the receiver for a mobile terminated call, or why the fact that the call can reach the recipient anywhere in the coverage area is only of benefit to the receiver of a mobile call, and not to the person originating the call. A caller who knowingly calls a mobile number expects to benefit from the mobile network.

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[5] Apart from the new areas of regulation identified here, it is not clear that BaK would enable NRAs to avoid network cost modelling. The CP is clear that information (and/or premium) services will need to be excluded from the BaK regime. It is also the case, however, that regulated origination payments will also need to be retained for both 0800 freephone services and carrier pre-selection (CPS), where the fixed incumbent retains market power. Continued regulation of these services will necessitate the continuation of long run incremental cost (LRIC) modelling of fixed incumbent networks in exactly the same detail as exists at present. In particular, for CPS, NRAs will still need to model the LRIC of both call origination and call termination on the incumbent fixed network – essentially exactly the same activity that they currently undertake to set regulated termination rates. Ofcom's "Telecommunications market data tables, Q1 2009" (http://www.ofcom.org.uk/research/cm/tables/q1_2009/q1_2009.pdf) shows that in 2008, 23% of fixed network calls fell into the category of non-geographic number calls of this type. In addition indirect access calls (which can be taken to be CPS) accounted for 28% of all national geographic calls, 33% of international calls and calls to mobiles.

[6] There is an exception in France where the MTR is only applicable for calls handed over in the same zone – otherwise an additional transit charge will apply.

It follows that mandated BaK as proposed by the CP results in an irrational asymmetry of cost sharing between call originators and call receivers on mobile and fixed networks. The obvious solution to this, should mandatory BaK be introduced, would be to allow mobile networks equivalent access to fixed network via BaK at just one (or any) POI. Effectively, fixed-fixed BaK would apply at the defined boundaries suggested by the CP, whilst mobile-mobile, mobile-fixed and fixed-mobile would need to be permitted at any POI in order to provide equivalent access.

3. The underlying economic rationale for BaK is flawed

3.1 The CP's economic case relies on unproven call externalities, the existence of which would annul the need for call termination regulation

The CP is correct in noting that the existence of call externalities (if any) could mitigate the need for cost based termination but, as the CP recognises, measurement of any call externality is virtually impossible.

The argument that the willingness of subscribers in receiving party pays (RPP) schemes to accept calls despite having to pay for them is evidence of a call externality is fallacious. US subscribers have a long history of paying to receive calls, but all market research evidence in Europe of which Vodafone is aware shows a significant customer reluctance to pay for incoming calls.

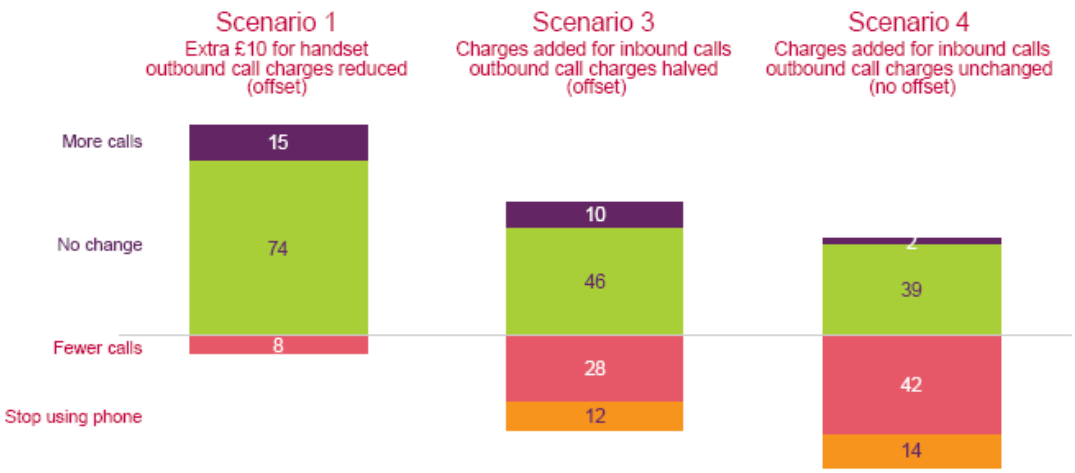
The reluctance of customers to accept charges for incoming calls in Europe is evidence of a low call externality. This is clearly shown in Ofcom's most recent market research commissioned from Jigsaw Research and published as Annex 10.2 to Ofcom's "Wholesale mobile voice call termination: Preliminary consultation on future regulation".[7] This statistically robust quantitative research looks at a number of options for rebalancing mobile retail prices and concludes:

> *The receiving party pays (RPP) options are likely to have the greatest impact on users' calling behaviour and are, by far, the least preferred options. The following two charts show the effect RPP suggestions would have on outbound calls (for PrePay and the PostPay customers)…"*

The principal results are reproduced in Chart 1 below. These charts show (Scenario 3 and 9 for PrePay and PostPay respectively) that the introduction of RPP with the off-set of halving outbound call charges would result in a net balance of fewer calls by 18% (28%-10%) of PrePay customers and by 25% (34%-9%) of PostPay customers. In addition, 12% of PrePay customers say that they would stop using their mobile phone altogether were charges to be made for incoming calls.

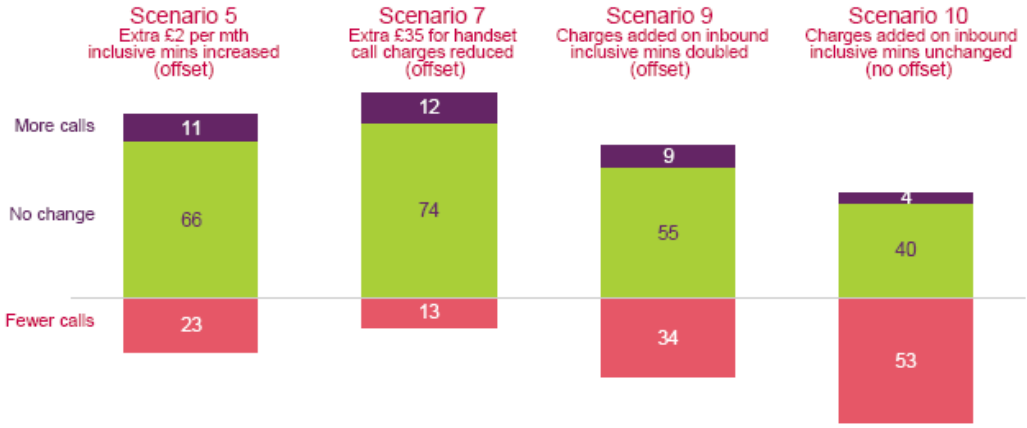
[7] See http://www.ofcom.org.uk/consult/condocs/mobilecallterm/annex10_2.pdf

Figure18 - PrePay scenarios: impact on outbound calls



Base: Pre-pay Customers - Sample A (n=311), sample B (n=294)

Figure19 - PostPay scenarios - impact on outbound calls



Base: Post-pay Customers - Sample A (n=175), sample B (n=199)

Chart 1 (Reproduced from Ofcom Consultation Document)

Source: Jigsaw Research, on behalf of Ofcom

These results show that UK users would react to imposition of incoming calls charges (to the extent that network operators would likely not implement them), implying that users place a lower value (or no value) on incoming calls. The results published by Ofcom for the UK are further supported by those of the TNS survey conducted on behalf of Vodafone in the Germany, Italy, Romania, Spain and

the UK.[8] A copy of the TNS report is attached to this submission. Consistent with the Ofcom results, the TNS conjoint analysis found that imposition of incoming call charges was consumers' least preferred option for rebalancing prices as a result of loss of incoming termination revenue, again showing consumers' valuation of incoming calls is limited.[9]

There is a further paradox to the call externality debate – namely that if customers really did value receiving calls (as the ERG seem to assume) and were thus sensitive to the costs imposed on others for calling them, we could expect mobile termination rates to be an important element in the network selection made by customers. In other words, large call externalities would imply that mobile operators would already be subject to competitive constraints upon their own mobile termination charges. Consequently the ERG would not need to mandate BaK, since network operators would implement it voluntarily.

In such circumstances, it is not clear to us that the ERG would be able to sustain the current approach to market definition for mobile termination services since NRAs following the ERG's CP would be unable to find SMP.

3.2 On-net/off-net price differentiation

BaK (or low termination rates) is sometimes proposed as a remedy for the perceived problem of large networks being able to entrench their position through the use of on-net price discounting – and a short reference is made to this in the CP. It is argued that a higher proportion of the larger network's subscriber base is able to benefit from lower on-net pricing, whilst the smaller network is unable to match the lower prices to so many subscribers because of the termination rates paid on off-net calls. A further argument is that smaller networks need to respond to on-net pricing by reducing their weighted average price (to below that of the large networks), thus stimulating a disproportionate volume of outgoing traffic and, as a consequence, suffering a net deficit in interconnection payments.

The first point to note is that even if this was a situation that required regulatory intervention BaK is not the appropriate response. Indeed, as pointed out earlier, mandated BaK would more likely result in a situation where off-net prices would be below on-net. Rather, the appropriate response would be cost based termination pricing (as recommended by the EC).

There are a number of reasons why the concern of on-net price discounting is miss-placed, and Vodafone has already published extensive research on this issue.[10]

First, the claim of unfair advantage in favour of larger networks is misplaced because it ignores incoming revenues. Smaller networks receive greater incoming revenue per subscriber than larger networks because a higher proportion of their calls are both made and received off-net. It is true

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[8] See Vodafone submission to EC consultation on termination rates at http://ec.europa.eu/information_society/policy/ecomm/library/public_consult/termination_rates/index_en.htm
See paragraphs 25.1 to 25.5.

[9] See TNS "Mobile Phone Usage", August 2008, attached to this submission. See slides 24, 28, 32, 36 and 40..

[10] See "On-net pricing in mobile", Public Policy Series, No. 8, April 2008 (attached to this submission). Also Available at http://www.vodafone.com/etc/medialib/public_policy_series.Par.36981.File.dat/public_policy_series_8.pdf. See also Vodafone submission to ERG consultation on Common Position on symmetry of mobile/fixed call termination rates, January 2008. Available at http://www.erg.eu.int/doc/publications/consult_symmetry_mf_tr/vodafone.pdf. See page 9.

that the smaller network incurs greater interconnection costs per subscriber, but also receives greater incoming interconnection revenues and is able to use this additional MTR revenue to either (1) offer lower on-net prices, (2) reduce monthly rentals where applicable, or (3) provide additional subscriber acquisition subsidies. Simple models, where all subscribers make equal numbers of calls proportionally to subscribers on both networks, show that networks of very different sizes are nonetheless able to offer exactly the same overall value to their subscribers. A larger network may offer on-net prices for a greater proportion of its subscribers' calls, but the smaller network is able to use its greater incoming revenue per subscriber to provide equivalent benefits to its subscribers through even lower on-net prices, or other reduced payments.

This is confirmed by the fact that we see smaller networks readily engaging in competition based on on-net pricing discounts, and often lead the trend. An OVUM report for Vodafone[11] finds:

> *Where both large operators and small operators in a country offer on-net discounts, the discounts offered by the smaller operator, normally a newer entrant, are typically deeper... This is what we would expect in a competitive market. The smallest operator carries a smaller proportion of on-net calls than the largest. So the costs of offering a given discount is less.*

Secondly, whilst small network operators sometimes claim that MTRs (particularly above cost MTRs) force them into a situation of traffic asymmetry, this is simply not supported by detailed analysis. Whilst MTR induced on-net/off-net price differentiation does affect traffic balances between large and small operators, a simple numerical simulation under plausible assumptions demonstrates that its magnitude is trivial and does not explain the traffic imbalances that many smaller operators actually experience. Traffic imbalances experienced by network operators such as H3G in the UK are caused by a commercial decision to target high usage customers (who are themselves responsible for traffic imbalances). They are not an inevitable structural consequence of small network operator market entry nor of current MTR arrangements. Annex 2 provides a further analysis on this issue.

Thirdly, it is very important in this context for the ERG to distinguish between competition and unfair competition. Competition from larger networks – including low prices for on-net calls – is certainly uncomfortable for smaller networks. It is intended to be. Consumers benefit as a result. The question for the ERG is whether such action is actually anti-competitive and runs the risk of reducing competition in the market in the longer term. There is simply no evidence to support this claim, or to suggest that firms of the scale that we see throughout Europe today are in danger of exiting the market as a result of on-net pricing. The ERG's task is not to reduce competition in order to make life easier for particular firm. It is to safeguard the competitive process as a whole. If smaller operators believe that larger networks are engaged in anti-competitive conduct then they are able (and have shown themselves very willing) to bring a case before the relevant competition authorities. As the ERG's own "Revised Common Position on the approach to Appropriate remedies in the ECNS regulatory framework" acknowledges:

> *There is no presumption that any such on-net discounting will inevitably distort competition in this way even if it prevented particular competitors from offering the relevant package. Each case would need examination on its own merits. Nevertheless, where this was a legitimate concern, a non-discrimination obligation would be an ineffective means of dealing with it, unless complementary obligations were applied in the relevant retail market. (See page 114)*

[11] Ovum, "On-net call discounts, A Report for Vodafone", 23 September 2004. See page 7.

4. CP doesn't adequately assess impact of BaK on investment price signals

4.1 BaK prevents price signals for efficient use of peak/off-peak capacity

BaK, by setting a zero price for call termination, excludes the use of peak/off-peak price signals for call termination, and so reduces incentives to invest in peak time of day capacity. In other words, the terminating network will be obliged to terminate calls for a zero price at its busy hour when capacity is most severely constrained.

For example, call centres generating calls will be given no incentive to conduct their activities outside of the network busy hour, especially if their service provider connects them with dedicated capacity directly to the BaK POIs of the terminating network.

By contrast, the CPNP regime allows network operators to de-average termination rates in a way that, when reflected in originating call retail prices, will encourage efficient use of both the originating and terminating network capacity.

4.2 BaK will encourage inefficient use of network by unsolicited calls

Mandated BaK will distort traffic patterns as call generators will not bear the cost of call termination. The most likely consequence of this will be an excessive volume of unsolicited calls providing little, no, or negative value to end users.

In particular, under mandated BaK, operators will have strong incentives to offer extremely low prices to large call centres generating large volumes of unsolicited calls – particularly SPIT (SPAM over IP telephony). This would simply involve transporting traffic from the call centre directly to the BaK POI over a high capacity trunk with virtually no switching or routing required.

In the case of terminating calls to mobile networks the originating network would need only to connect the call centre to a single POI on the mobile network. The terminating network would then bear the bulk of the cost of delivery, since the cost of mobility and routing, as well as the radio access network capacity, would be borne by the mobile network. The ERG would presumably argue that this is fair because the mobile customer gains utility from receiving the call over a mobile network. This seems far fetched in the case of a call generated from a call centre.

It is clear that mandated BaK will open a huge opportunity for unsolicited SPAM/SPIT calls to mobile numbers in particular, generating huge capacity costs on radio access networks for unwanted calls. The problem will be even more pronounced with BaK applied to SMS.

4.3 The ERG's proposals are likely to lead to inefficient arbitrage

In principle it may be possible to set separate BaK regimes for fixed-fixed and mobile-mobile calls, but past experience shows such a system would be undermined by arbitrage (e.g. the use of SIM boxes to re-originate fixed-mobile calls as mobile-mobile). Until 2004 France operated a BaK regime between mobile operators. This was ended following realisation that BaK was "not sustainable if implemented partially in the industry".[12]

[12] See "Bill and Keep in the French Mobile Industry: a Case Study", presentation by Benoit Loutrel (Arcep), WIK Conference April 2004: http://www.wik.org/content/bill_keep/konf_bill_and_keep_2006/Session%20V/french%20buk%20-%20loutrel%20-%20wik%20conference%20april%204-5.ppt

Even if implemented for all sectors of the telecommunications industry (i.e. fixed-fixed, mobile-mobile, mobile-fixed and fixed-mobile) arbitrage opportunities still exist. These involve call back schemes where a subscriber signals an instruction (e.g. over the Internet) to a call back platform which then constructs a voice call by putting together two terminating network segments. Under mandated BaK neither of these two segments need incur any interconnection cost (other than possibly a very small amount of transit).[13] Schemes such as these would clearly undermine the commercial integrity of the BaK regime since any retail charge accrues to the call back platform alone, with no necessity to pass any cost recovery to either the originating or the terminating network.

Mobile networks are particularly exposed since the traffic sensitive cost on mobile networks is higher. For this reason calls originating on mobile networks are priced higher (or bundles are more expensive) and the incentive to engage in call-back to provide calls at zero cost through arbitrage of the mandated BaK regime will be greater.

[13] Google Voice already does this over the Internet. Under mandated BaK, however, the problem is worse since networks do not even earn revenue from Internet connectivity for the call duration (only the initial call set up).

5. ERG ignore distributional effects of BaK

5.1 The CP ignores the issue of marginal subscribers

The ERG assesses the benefits of moving to BaK in terms on one metric alone: call volumes per capita. By doing this it ignores distributional effects. For example, it assumes that the loss of a call by a pre-pay subscriber (who may no longer be able to afford network access) is equal in welfare terms to an additional call made by a high user as part of a large bundle. This is despite all the evidence of pricing structures that shows that pre-pay users are prepared to pay a much higher unit price for a small number of calls than large users.

At a minimum, the ERG's welfare assessment should look at:

- Usage per subscriber; and
- Number of subscribers with network access.

Perhaps more importantly, however, is the impact on bills of low users who may not churn off the network, but be required to pay more to retain their pre-pay subscription.

Again, Ofcom's most recent market research commissioned from Jigsaw Research and published as Annex 10.2 to Ofcom's "Wholesale mobile voice call termination: Preliminary consultation on future regulation" provides robust quantitative data on the impact of mobile retail price rebalancing that may occur as a result of a significant reduction in MTRs, as would be the case in a mandated move to BaK.[14] The key results are reproduced as Chart 2 below. Jigsaw Research found that in response to lower call prices off-set by a £10 increase in handset prices (i.e. £10 lower subsidy) 69% of pre-pay customers would be "very unlikely" to stop their mobile service, 21% would be only "fairly unlikely" and 8% would be "likely" to stop mobile service (see Scenario 1). Again, these results published by Ofcom for the UK are similar to those of market research conducted by TNS on behalf of Vodafone in the Germany, Italy, Netherlands, Hungary, Ireland, Portugal, Romania, Spain and the UK.[15]

[14] See http://www.ofcom.org.uk/consult/condocs/mobilecallterm/annex10_2.pdf

[15] See Vodafone submission to EC consultation on termination rates at http://ec.europa.eu/information_society/policy/ecomm/library/public_consult/termination_rates/index_en.htm
See paragraphs 22.1 to 22.2.

Figure 20 - PrePay scenarios: likelihood to stop having a mobile

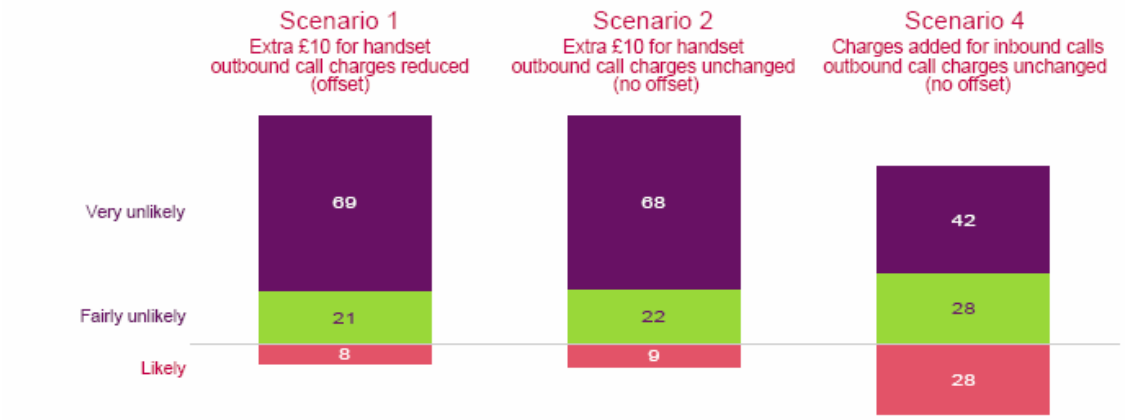

Chart 2 (Reproduced from Ofcom Consultation Document)

Source: Jigsaw Research, on behalf of Ofcom

5.2 The ERG will need to consider a USO scheme

Despite claims made in the CP, it is clear that mobile ownership in the US is lower than that in Europe. Vodafone studied this extensively in its response the EC recommendation[16] and some updated results are shown in Table 2 below. It remains clear that the UK has a considerably better develop pre-pay sector (61% compared to only 17% in the US) and consequently 92% of households with access to a mobile phone, compared to 80% in the US. Results are similar in most other EU countries. This margin of 12% of households without access to mobile telephony in the US raises series universal service issues under a low MTR regime.

Table 2: Mobile take-up in UK & US

	UK	US
% pre-pay	61%	17%
Subs/population	*127%*	*93%*
% of households with mobile	92%	80%

Source: Ofcom, Wireless Intelligence (October 2009) & CDC

It seems unlikely to Vodafone that BaK could be introduced without the parallel introduction of a USO (universal service obligation) scheme to protect the low voice users. Such a scheme is of course conceivable, but must be consulted on and constructed before a move to mandated BaK is considered.

One of the biggest challenges for any USO scheme is in its targeting towards genuinely marginal users. Ideally the scheme should be restricted to individuals who would otherwise not take a mobile service for any reason – principally affordability. Historically USO schemes in some countries have been linked to either low usage, or in some cases receipt of government social welfare payments. The former is often an inaccurate target since consumers can be low users but still find the service

[16] Op.Cit.

valuable and would be prepared to pay a higher price. The latter is administratively burdensome and not always well targeted. By contrast, the existing MTR regime effectively targets users who are predominately net receivers of calls. There is good reason to believe these users would be efficient recipients of the USO subsidy (since they find less value in the services themselves, compared to those who wish to call them).

5.3 ERG draws casual and incorrect inferences from empirical observation of CPP vs. RPP countries

The CP states that the ultimate test of the effectiveness of a BaK regime should be on observed outcomes of high versus low MTR countries. Although claiming to be evidence based, the CP uses casual observations (with no statistical validity) and graphs that are both selective and do not control confounding factors. At the same time the CP ignores more rigorous published econometric analysis.

The CP claims to present data showing that BaK countries:

- Have retail prices per minute (RPM) of half the level of CPNP countries;
- Have twice the minute of use (MoU) per capita as CPNP countries;
- Have no significant differences in mobile ownership.

The CP's evidence comes from two dimensional graphs of RPM, MoU and mobile penetration (Figures 1 and 2 in the CP). No attempt is made at any formal statistical analysis. This omission is important for two reasons.

Two dimensional analyses ignore all other factors that influence RPM, MoU and penetration. A proper analysis requires econometric investigation. In particular, the CP's analysis is severely limited by having only one cross-section dataset. A proper econometric analysis would also make use of a longitudinal time dimension. A cross section analysis simply cannot control for country specific fixed effects. The data source used by the ERG is very susceptible to proper econometric analysis of this kind, and at least two published studies have been done (one of which was sponsored by Ofcom). The CP makes no reference to either of these studies.

To draw any statistically robust conclusions from the cross-sectional data provided by the ERG would require, at a minimum, a number of BaK countries to be included in the sample. The ERG includes only three:

- Hong Kong and Singapore, both of which are city states and would clearly have other relevant factors (such as consistently high population density over most of the network coverage area giving very low coverage costs feeding through to both low RPM and high MoU), as well as GDP per capita's over double those of most European countries;[17]
- United Sates: with a significantly high GDP per capita, especially when compared on the correct Purchasing Power Standard (PPS) basis. Latest data published by Eurostat for 2008 reports GDP per capita (on PPS) of the US to be 54.4% above that of the average of the EU-27, 49.2% above the average of the UE-25, and 39.6% above the average of the EU-15.[18]

Since Hong Kong and Singapore are clearly not comparable, the ERG is attempting to draw statistical inferences from a sample of one (the US – and even this country has a very different GDP per capita). It is unsurprising that any observed difference is not statistically significant.

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17 http://en.wikipedia.org/wiki/List_of_countries_by_GDP_(PPP)_per_capita

18 http://epp.eurostat.ec.europa.eu/portal/page/portal/national_accounts/data/main_tables

Inclusion of Canada in the analysis would improve the statistical validity by doubling the sample of low MTR countries. Ofcom commissioned a study of the interconnection arrangements in a number of countries, including Canada, and although some capacity based charging does exist, it is clear that overall the system is far closer to the US low termination rate regime than a European style CPNP regime.[19] Furthermore, the GDP per capita on a PPS basis for Canada is much closer to the EU average than that of the US.[20]

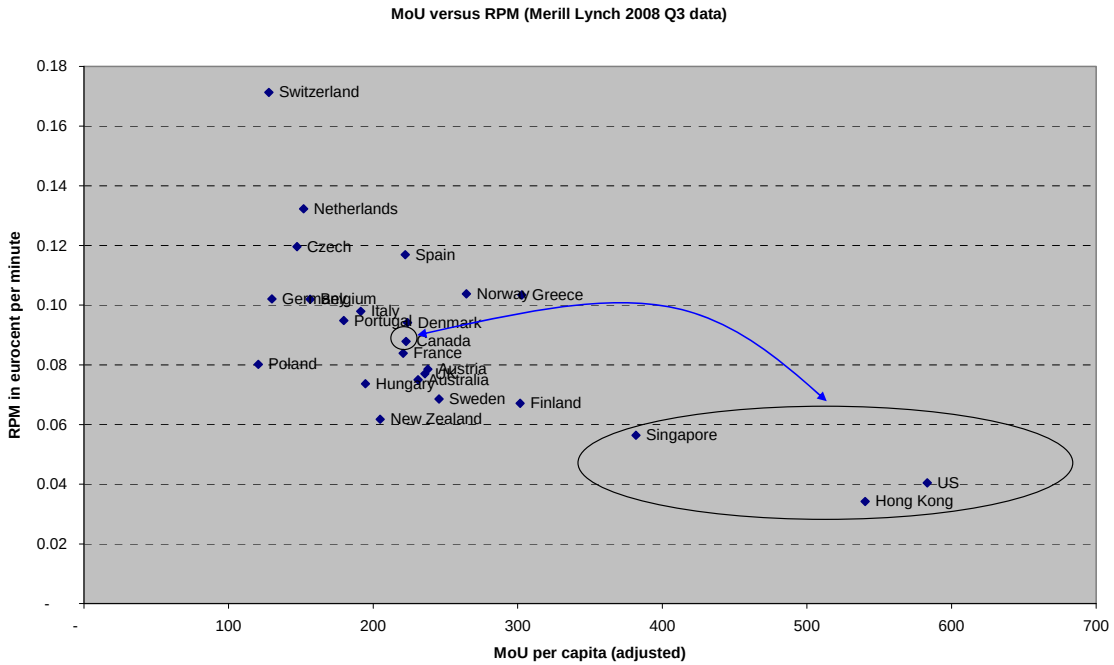

Chart 3: Re-computation of ERG's Figure 1 including Canada

5.4 Robust econometric analysis of the ERG's chosen dataset is available, but was ignored by the CP

Two recent academic analyses of the ERG's chosen Merrill Lynch dataset are available. The first by Hazlett and Munoz, published in a prestigious peer reviewed academic journal,[21] was motivated by the objective to quantify the impact of spectrum allocations on the price and demand for mobile minutes. However, in analysing exactly the same Merrill Lynch dataset as used in the CP, its findings are also relevant to the BaK debate. The paper employs a rigorous econometric analysis incorporating the impact of:

- population density;
- GDP;
- the price of fixed network calls (as a substitute);
- a dummy variable to control for whether or not spectrum was awarded by auction; and

[19] See "Case studies of mobile termination regimes in Canada, Hong Kong, Singapore and the USA", Annex 8.1 – Report by Analysys Mason for Ofcom. http://www.ofcom.org.uk/consult/condocs/mobilecallterm/annex8_1.pdf

[20] According to the OECD the GDP per capita (on PPP basis) for Canada is only 19% above the euro-zone average, compared to 41% for the US. See http://www.oecd.org/dataoecd/61/54/18598754.pdf

[21] Thomas W. Hazlett and Roberto E. Munoz, "A Welfare Analysis of Spectrum Allocation Policies," *RAND Journal of Economics* Vol. 40 (Autumn 2009). Version available at http://mason.gmu.edu/~thazlett/pubs/Rand.TH.RM.12.5.08.doc

- a dummy variable for non-CPNP interconnection regimes.

The analysis finds, amongst other conclusions, that there is no statistically significant positive impact on total mobile call volumes of operating a non-CPNP regime relative to CPNP (in fact the estimated impact of non-CPNP was negative albeit not statistically significant at the 5% level).

The second recently published study is by CEG, and commissioned by Ofcom.[22] This study, using the same Merrill Lynch dataset, also incorporates essentially the same set of controlling factors as the study on Hazlett and Munoz (population density, GDP per capita, fixed network penetration), and yields consistent conclusions:

- Mobile penetration is statistically significantly higher in countries that adopt a CPNP regime;
- There is no robust statistical evidence of the relationship between usage and the level of MTRs;
- There is no robust relationship between the level of MTRs and the (average) level of retail prices.

There are two principal reasons why the CP's simplistic charting (and other similar analyses) incorrectly interprets the Merrill Lynch data:

- By omitting to account for GDP per capita and population density the CP seriously over-estimates any impact of the non-CPNP regimes in the US, Hong Kong and Singapore;
- By looking at a cross section at just one point in time (2008 Q3) the analysis ignores all the past history of calling patterns. This is particularly important in the case of the US because the very high level of minutes per capita is a relatively new phenomenon – see Chart 4 which compares the growth in MOU per capita for the US with the median of all European countries in the Merrill Lynch dataset. The graph shows that in 2002, US MOU per capita was a more modest 64% above the median European country (a difference explained by differences in GDP per capita at PPS), and it is only since then that the margin has opened up to its existing level of 161%. However, the US has always operated essentially the same interconnection regime for cellular networks with either low termination rates or BaK, whereas the termination rates in CPNP countries have declined significantly over this period. The hypothesis that high minutes of use per capita are driven by low termination rates or BaK is clearly refuted by this time series analysis. If there was a relationship we would have expected to see MoU growth of CPNP countries to have exceeded that of the US over the period 2002-2008, whilst in fact the reverse is true. Whilst this times series dimension is missed in the ERG cross-section analysis, it is captured in the panel data analysis of both Hazlett and Munoz and CEG.

[22] Dr Barbara Veronese and Prof Martin Pesendorfer (CEG), "Wholesale Termination Regime, Termination Charge Levels and Mobile Industry Performance", published as Annex 7 of "Wholesale mobile voice termination", Ofcom, 2009. See http://www.ofcom.org.uk/consult/condocs/mobilecallterm/annex7.pdf

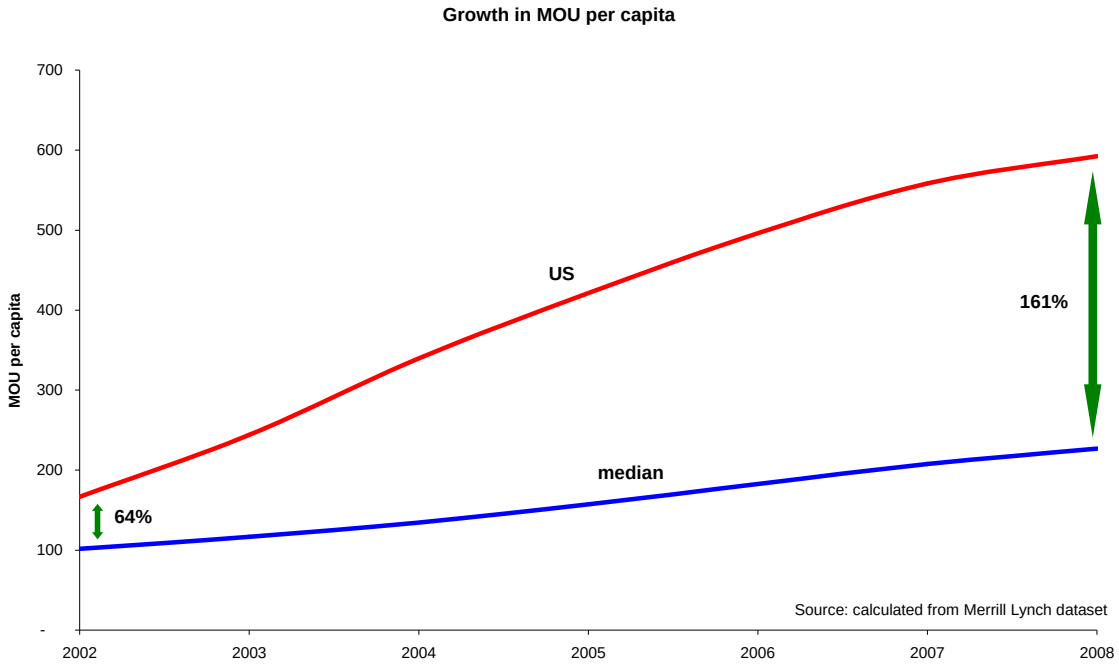

Chart 4: Relative growth of US MoU/capita

The ERG should seek expert statistical guidance to evaluate the available evidence from the Merrill Lynch dataset. It cannot rely on its own selection of graphically appealing data.

6. Issues of transition to voice IP interconnection

The CP seems to suggest that there is a risk of conflict between the existing interconnection for circuit switched voice calls and a multi-service NGN regime based on IP technology – in other words a possibility of arbitrage between two (or more) apparently different interconnection models: one for "best efforts" packet data carried over the public Internet and one for QoS voice (or other services). These two models provide distinctly different services to end customers: full PSTN inter-working functionality of call control under quality of service standards, compared to best efforts quality with limited PSTN inter-working functionality.[23]

There is no reason why these two models should not co-exist. Customers' voice traffic can be carried as normal "best efforts" IP traffic over the existing patchwork of peering and paid transit arrangements. The quality may be sufficient most of the time, but there will be a risk of congestion and latency at busy times, and generally call quality levels may not be adequate (measured, for example, by MOS[24] scores). Levels of congestion over the public Internet and on mobile access networks may increase further in future. Furthermore PSTN features such as CLI (calling line identity) will not necessarily be provided. Of course, IP interconnection standards that do provide full PSTN quality and features are now being developed but at present the only one available for deployment is SIPI-I. This is most likely to be the standard chosen for voice IP interconnection where quality is important.

In future NGN environments, therefore, mobile customers will be able to use:

- voice services using their chosen VOIP client; and/or
- voice services directly provided by their own network service provider using IP transmission and interconnection (of which they will be unaware).

In the former case the voice interconnection will effectively be provided by existing peering and paid transit arrangements. These arrangements are not BaK, and interconnection by these arrangements does involve costs to the operators, either directly in paid transit charges, or more significantly in the network costs of maintaining peering status. These costs will be recovered by the retail prices for the data package from the network operator. There will, however, be no guarantee of service levels (e.g. call blocking, latency and MOS levels) either in the present or for the future.

Alternatively, mobile customers can, if they wish, use voice services provided by their network service operator, currently provided using TDM interconnection, but which can be expected to migrate to SIP-I interconnection in future. These services will be managed by the network operators to provide service quality that customers currently expect, and network operators can be expected to maintain (or improve) these levels for future.

In some instances, and for some consumers[25], the two forms of voice service may appear to give the same outcome. There will, however, be important differences in terms of functionality (e.g. CLI based features, as well as call forward and services based on call forward) and the network and management costs that need to be incurred to provide these service level guarantees now and for the future. In future, as traffic levels on the public Internet continue to rise, it is quite likely that the respective service qualities will diverge further.

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[23] Most importantly voice termination over existing IP best efforts interconnection would not have the capability of alerting the receiving party to an incoming call unless there was an "always on" IP connection to the handset, and the calling party was aware of this.

[24] Mean Opinion Score – the scale of 1 to 5 is standardised by the International Telecommunications Union (ITU).

[25] Consumers who currently choose to use Skype or similar services are a case in point.

The ERG's concern to minimise arbitrage between existing voice services and IP based networks and voice over the Internet is misplaced. The form of transmission technology deployed by networks (either circuit switched or packet based) for voices services and interconnection of those services has no bearing on the commercial or regulatory interconnection regime. Both will work in the existing CPNP regime. Furthermore, voice services provided by the networks under a CPNP regime can (and should) co-exist with voice provided over the Internet from clients downloaded onto customer devices.

7. Capacity based charging

The ERG has ignored any other alternatives by treating this complex issue as simply a "two horse race" between existing per minute termination rates and BaK. This is disappointing since the ERG is attempting to formulate a long term strategy, in which it should be possible to explore all options. In particular, Vodafone believes that capacity based charging (CBC) has many advantages and we urge the ERG to fully explore other alternatives to BaK.

Vodafone believes that interconnection payments based on capacity (rather than traffic) might allow retail tariffs to better reflect underlying cost structures of the terminating networks. In particular, it could encourage fixed and mobile network operators to stimulate additional traffic outside of the terminating network, since the marginal cost of termination of this traffic away from the peak will be low under CBC. To the extent that consumers gain utility from the new traffic there will be a clear gain in consumer welfare. The counter-side to this is the possibility that originating networks will face a higher marginal cost for traffic in the busy hour that contributes to peak capacity. This would however generate appropriate price signals for the cost of this traffic, and to the extent that operators are able to flatten or shift this peak will lead to greater network utilisation and consequently more efficient network investment – something that is also welfare enhancing.

CBC is, therefore, not an intermediate step between the existing system and BaK as the ERG suggested during the Brussels workshop in November. Rather it is a fundamentally different way of pricing interconnection that more closely mirrors the underlying cost structure of the network operators providing the service, and so can be expected to lead to more economically efficient pricing. Unlike BaK (and existing single 24 hour rate CPNP pricing), it will encourage efficient time of day network pricing and lead to a much higher efficiency of use of the network.

Table 3 summaries the relative merits of the existing CPNP per minute charging regime, against CBC and BaK. The comparison is striking for two reasons:

- The only areas where BaK has advantages over the existing CPNP regime (retail pricing flexibility and regulatory simplicity) also entail significant drawbacks. Against this BaK has significant drawbacks in a number of areas, generally associated with efficient use of the network and lack of incentives to preserve quality of service for call termination (leading in the extreme to connectivity breakdown);
- CBC provides either the same or greater benefits than BaK in all cases. In particular, it achieves retail price flexibility (but within the constraints of efficient use of the network to reflect underlying capacity costs), but also allows for efficient time of day price signals, which the existing CPNP regime does only partially (in some countries), and BaK will fail to do at all.

In summary Vodafone believes the ERG is investigating the wrong alternative model.

Table 3: Summary of different call termination regimes

	Existing per minute charging	CBC	BaK
Retail price flexibility	No - limited by per minute outpayments	Yes – within constraints of efficient use of network to reflect underlying capacity costs	Yes – but at cost of inefficient network use, and rebalancing of other tariffs
Efficient use of network	Yes – originators pay for termination usage	Yes – originators pay for termination capacity	No – anomalies of "free termination"
Efficient time of day use of network	No - limited to daytime, evening and weekend pricing allowed in some countries	Yes – encourages full time of day pricing	None – no incentive
Ensure quality of service	Yes - networks get paid for successfully terminated calls	Yes - networks get paid for terminating capacity	No – networks have incentive to restrict capacity for incoming calls. Potential connectivity breakdown
Competition	Allows competitive market	Allows competitive market	Lower quality on call termination (or connectivity breakdown) may favour larges networks with more on-net calling
Unsolicited SPAM/SPIT	Limited problem (addressable with other measures)	May be problem outside of peak periods	May be problem in all time periods
Implementation costs	Moderate (i.e. existing level)	High	High
Regulatory simplicity	Existing system functions well	Risk of new system	Avoids some price setting, but risk of new system

Annex 1: Answers to ERG's specific questions

Question 1: Do you agree that in a multi-service NGN environment, in which different services use a shared transport layer, different interconnection regimes for different services could create arbitrage problems? If yes, could you describe the problems that you foresee or that have already occurred.

See Section 6. Voice services under a CPNP regime can co-exist with the existing commercially negotiated arrangements for best efforts IP interconnection (peering and paid transit).

Question 2: What is the influence of the separation of transport and service for the interconnection regime and in particular the charging mechanism and in what way are NGNs and BaK related?

See Section 6. Vodafone sees a "service aware" network which can provide the quality necessary for each service to function properly, including voice. Our main concern, as described particularly in Section 2.2, is whether BaK will provide incentives for network operators to invest in sufficient capacity or prioritisation for terminating voice.

Question 3: How would you define the boundary for the application of BaK and where should it be located (i.e. points of interconnection where BaK is applicable)?

Vodafone' main concern with the CP proposal is the asymmetry of treatment between fixed networks (with local BaK boundaries) and mobile networks (with essentially national BaK boundaries). This is discussed in Section 2.4.

This asymmetry can be rectified only by extending the BaK boundary for fixed networks to national (ie. one POI) for purposes of fixed-to-mobile calls.

Question 4: What is your conclusion on the relationship between the charging mechanism and penetration, usage and price level?

See Sections 5.3 and 5.4.

Question 5: How does BaK affect regulatory certainty and the risk of legal disputes?

Contrary to what the CP appears to envisage, Vodafone believes that BaK will introduce considerable new areas of regulatory uncertainty associated not only with setting of BaK boundaries, but also the possibility that NRAs will find it necessary to introduce new regulation on quality of services because of the lack of incentive to invest in terminating voice capacity. See Sections 2.1-2.3.

Question 6: How do different wholesale charging mechanisms impact on the number of unwanted calls? Do you expect (other) effects on consumers/consumer groups? Where possible, provide a quantitative assessment of the expected effects.

See Section 4.2.

Question 7: How do you assess the quantitative relevance of call and network externalities?

See Section 3.1 (call externalities) and Section 5.1-5.2 (network externalities).

Question 8: How would your business be affected by a move from CPNP to BaK? Please explain the expected impact on prices, volume of supplied services and profit.

The most prominent impact of a move to BaK will be the rebalancing of consumer prices, entailing price increases for low users (and price reductions for large users). Market research conducted on behalf of Ofcom (see Section 5.1) provides the best indication of the market impact of these changes.

Question 9: Do you agree with the conclusion that operators/users in the BaK domain will subsidise traffic coming from outside the domain (regardless of the legal aspect)? Are there any mechanisms to prevent this and how will they work in your view, in particular to avoid arbitrage?

This subsidy will occur, and is an unavoidable consequence (or price to pay) for a move to a BaK regime.

Question 10: Do you see any implementation problems for a migration period towards BaK? How could such problems be addressed?

Vodafone sees considerable implementation issues discussed in Sections 2.1 to 2.3.

Question 11: Does the draft CP miss any other relevant issues?

Two additional areas have been omitted by the CP:

- The fact that BaK prevents any price signals for efficient use of peak and off-peak capacity (See Section 4.1);
- The CP has ignored all other alternatives for interconnection arrangements by treating this complex issue as simply a "two horse race" between existing CPNP per minute termination rates and BaK. This is particularly disappointing since the ERG is attempting to formulate a long term strategy and it should be possible to explore all potential options, some of which may be superior to both BaK and existing arrangements. In particular, Vodafone believes that capacity based charging (CBC) has many advantages over BaK, allowing efficient use of the network (at zero marginal cost outside of the busy hour), while providing full incentives for investment in new capacity. See Section 7. We urge the ERG to give alternatives a full and proper consideration.

Annex 2: Traffic imbalances, MTRs, On-net pricing and Traffic Imbalances

Introduction

Small mobile network operators (MNOs) sometimes claim to suffer an inevitable competitive disadvantage against larger MNOs because of interconnection traffic and payment imbalances caused by the need of the smaller MNO to undercut its larger competitor's off-net tariffs so as to neutralise the advantage of on-net tariffs to a larger subscriber base. Lower off-net tariffs by smaller MNOs, it is argued, cause traffic imbalances that disadvantage the small MNOs and should be remedied by adoption of Bill and Keep (BaK) in order to make traffic imbalances immaterial in terms of financial payments.

This annex shows that such claims are unfounded. Whilst MTR induced on-net/off-net price differentiation does affect traffic balances between large and small operators, a simple numerical simulation under plausible assumptions demonstrates that its magnitude is trivial and does not explain the traffic imbalances that many smaller operators actually experience. Rather, traffic imbalances experienced by MNOs such as H3G in the UK are primarily caused by a commercial decision to target high usage customers (who are themselves responsible for traffic imbalances). They are not an inevitable structural consequence of small MNO market entry nor of current MTR arrangements.

Numerical impact of on-net/off-net price differentiation

Case A: All MNOs have identical customer profiles

The numerical impact of on-net/off-net price differentiation is easy to assess through a simple simulation model. Please note that the prices and costs used in this illustration are purely notional. We assume:

- Three operators with subscriber shares of 46%, 46% and 8% respectively;
- Mobile termination rates of 12c, or zero under a BaK scenario;
- Marginal cost of call termination of 6c (per minute), and a marginal cost of call origination including retail costs of 12c;
- On-net prices are set to cover marginal costs. Therefore, the price of an on-net call is 12c+6c=18c;
- The price of an off-net call for the large MNOs is also set to cover costs. Therefore, large MNO off-net prices will be 12c+12c=24c under MTRs, but held at the same price as on-net calls (18c) under BaK. In the latter we may appear to depart from cost since, under BaK, the marginal cost of an off-net call would in fact be only 12c – less than the cost of an on-net call. However, MNOs may recover the difference either from a receiving charge on incoming off-net calls or, as we assume here, from equating on-net and off-net prices;[26]
- The price of an off-net call for the smaller MNOs is set to be competitive against large MNOs by setting a price that would equal that of the large MNOs for the blended average of on-net and off-net traffic. Therefore, smaller MNOs need to charge a lower off-net price to neutralise the impact of a smaller subscriber base. It is this that creates the traffic imbalance;

[26] Recovering the cost from off-net prices could be optimal due to "call propagation", where an outbound off-net call causes a return inbound call. MNOs would use the additional price of the former to cover the marginal cost of the latter.

- We initially assume that all operators have identical subscribers. We assume that 20% of all outgoing calls will be on-net irrespective of network size (e.g. within closed user groups) whilst the remaining 80% of calls will be distributed across all three networks in proportion to subscriber shares. We believe that the assumption of 20% of calls being on-net irrespective of market share is realistic. However, the results do not crucially depend on this assumption. In fact we can easily adopt the extreme case where 100% of calls are distributed according to subscriber shares without changing the overall conclusions. Under our base assumption, assuming that subscribers each make 1,000 outgoing call minutes a month, and assuming no on-net/off-net price differentiation, 568 minutes will be on-net for the large MNO, but only 264 will be on-net for the small MNO.

We now model the impact of on-net/off-net price differentiation through assuming a price elasticity of -0.6 on off-net call volumes; off-net volumes are lower under an MTR due to a higher price. Chart A1 shows the implications for the traffic balance of the smaller MNO. Since the price is higher for the larger MNO, the smaller network experiences a termination traffic deficit, amounting to 48 minutes/subscriber/year, compared to the situation of complete traffic balance under BaK.

Chart A1: Traffic balance when both all MNOs service identical customers

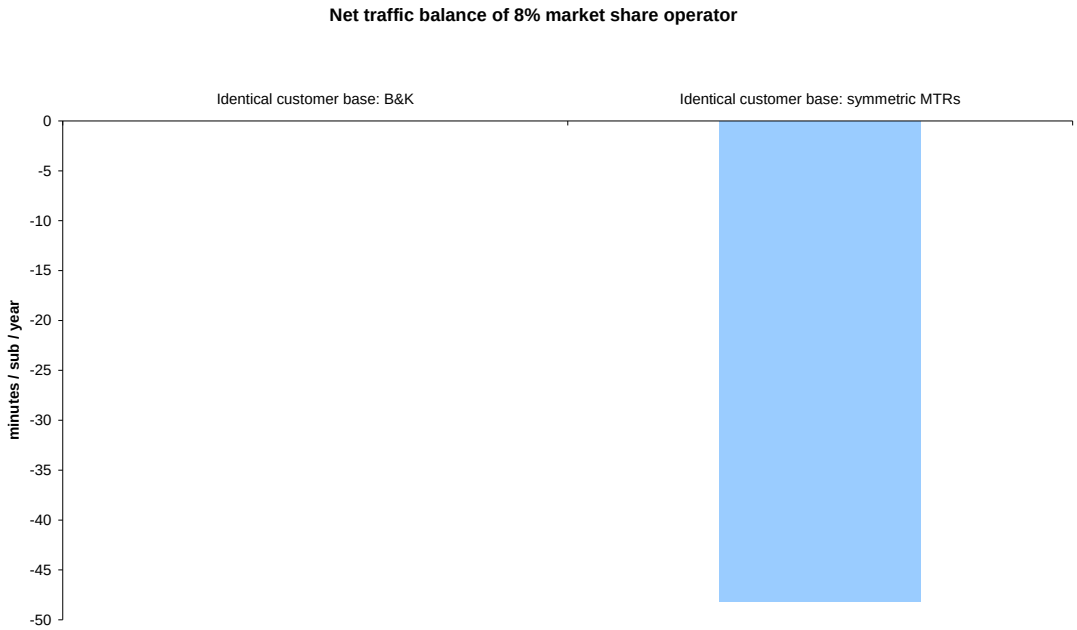
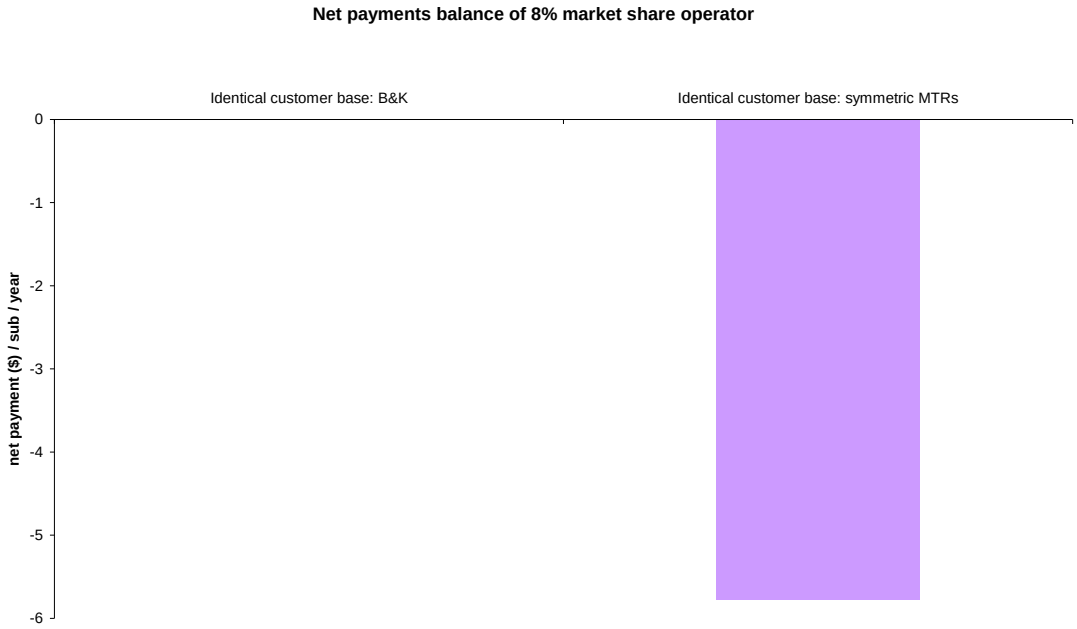


Chart A2 shows the payments situation for the smaller MNO on exactly the same assumptions. This simply mirrors the traffic balance: under BaK payments are exactly in balance (both because traffic is in balance and also because there are no MTRs in any case). When MTRs are introduced the termination traffic deficit results in a payments deficit.

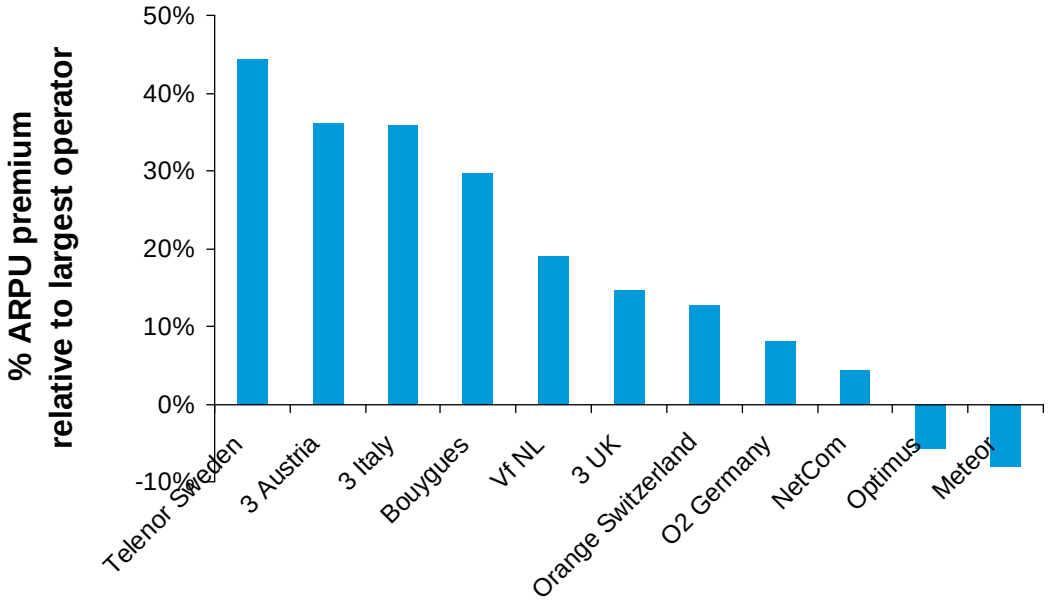
Chart A2: Payments balance when both all MNOs service identical customers



Case B: Smalls MNOs serve high usage customers

So far we have assumed that both networks serve identical customers bases. We now introduce a further element to the analysis by assuming that the new smaller MNO will target a customer base making 50% more outgoing calls. Chart A3 shows that this is a common strategy for small MNOs such as H3G in a number of its European operations.

Chart A3: ARPUs of Small MNOs



Source: calculated from Wireless Intelligence and Merrill Lynch Global Wireless Matrix

Chart A4 shows how this last assumption multiplies the traffic imbalance of the small MNO. The terminating traffic deficit from Chart 1 (zero under BaK and 48 minutes/subscriber/year under MTRs) is increased by an order of magnitude to 368 and 382 minutes/subscriber/year for the cases

of BaK and MTRs respectively. This demonstrates that whilst MTRs have a small impact on traffic balances, their effect is dwarfed by the impact of the customer base.

Chart A4: Traffic balance when small the MNO serves high users

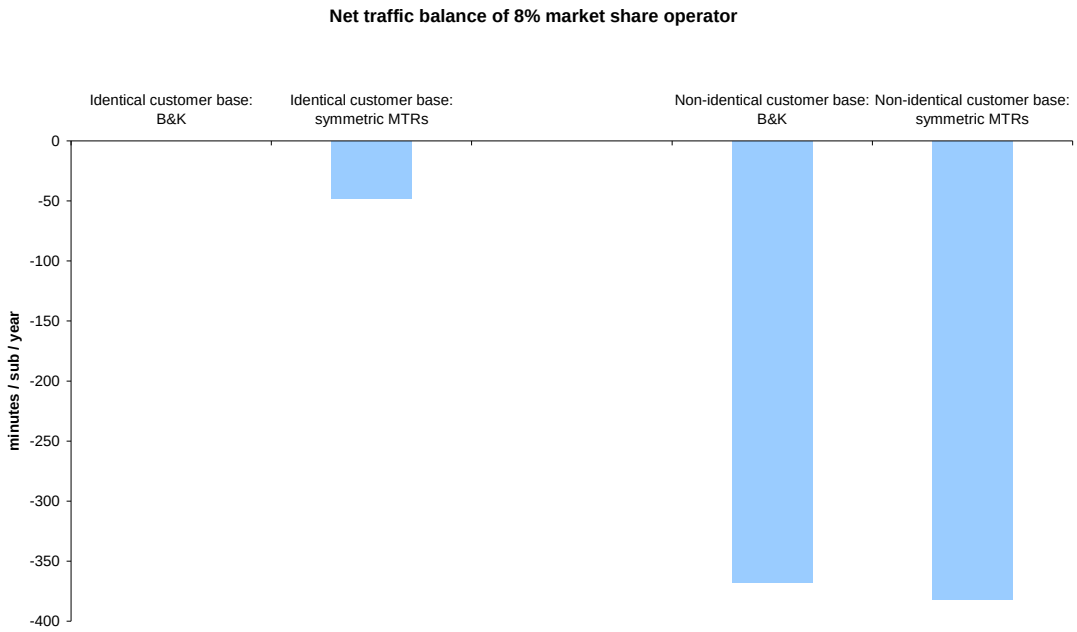
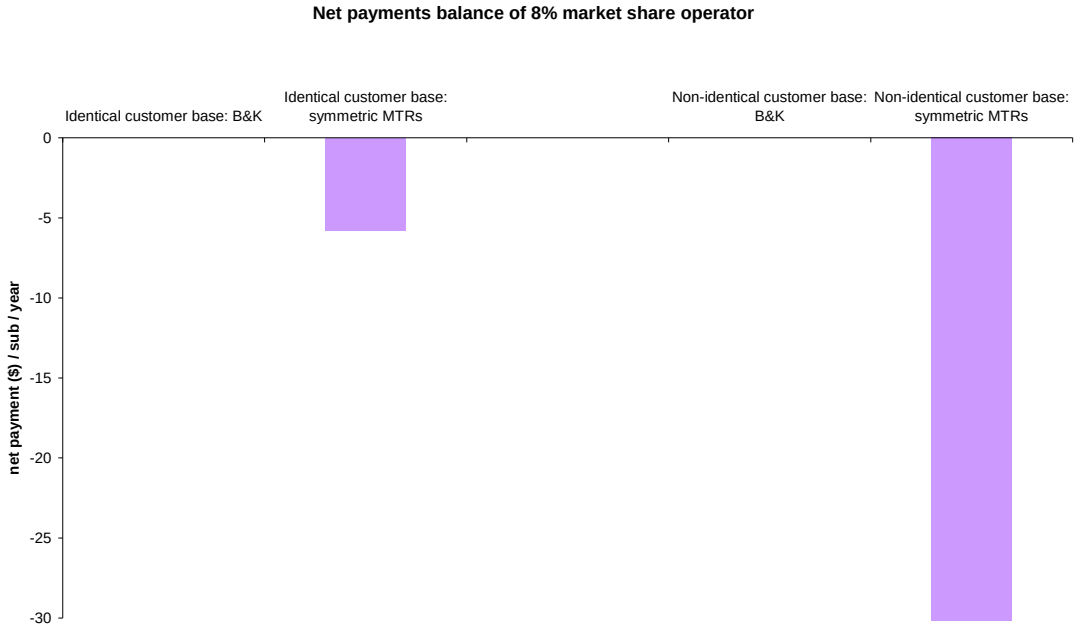


Chart A5 shows the situation in terms of the payments balance. This simply reflects the traffic balance in Chart A4, other than the zero net payments under BaK. Chart 5 clearly shows that the principal cause of payments imbalance under MTRs is the smaller MNO serving a high user customer base, rather than MTRs and on-net pricing alone.

Chart A5: Payments balance when the small MNO serves high users

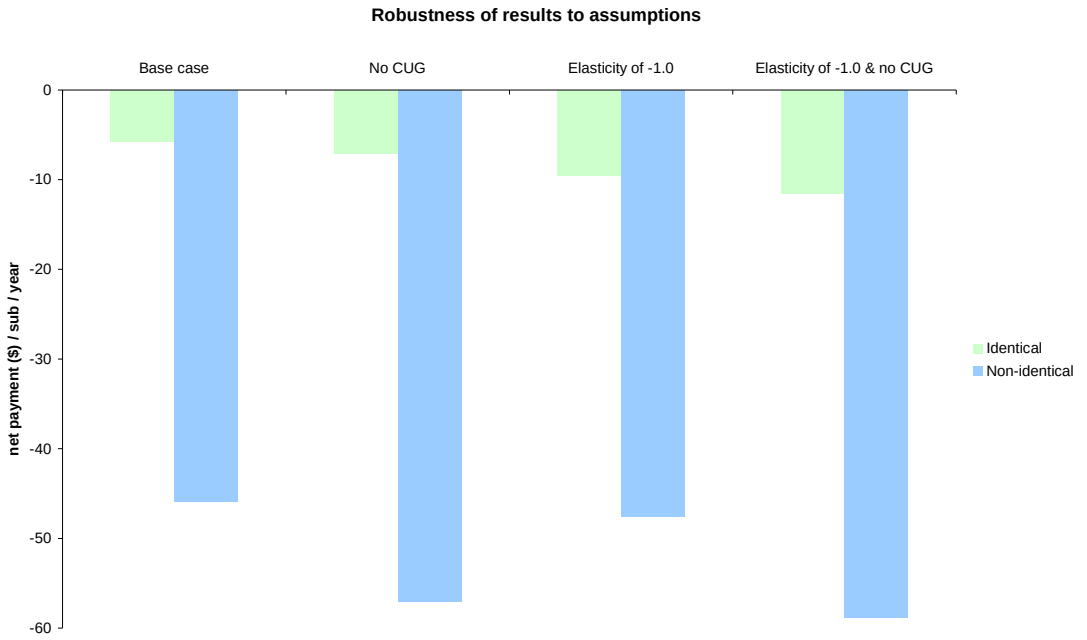


Robustness of results

Any simulation is dependent on assumptions. Critically, we have assumed a price elasticity of -0.6, and also that 20% of all outgoing calls will be on-net irrespective of network size (e.g. within closed user groups). In this section we change both of these assumptions. Chart A6 shows the net payments balance of the small MNO in cases of:

- price elasticity increased from -0.6 to -1.0;
- all calls distributed strictly according to market share (i.e. no closed user group effect); and
- combined effect of both the above.

Whilst increasing the price elasticity and eliminating the closed user group effect both act to increase the payments imbalance under identical customer bases, the effect remains minor compared to the impact of non-identical customer bases. Our conclusions, therefore, are robustness to these two key assumptions.



Conclusion

Our simple numerical simulation demonstrates that the impact of on-net/off-net price differentiation on traffic balances is extremely minor when compared to the impact of an MNO choosing to attract subscribers with 50% higher outgoing call volumes.

Whilst our model is based on a number of assumptions, we believe that these are realistic. The conclusion stated above is robust to a range of assumption permutations.