

Regulatory obligations to be imposed on operators with significant market power: narrowband services

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1 Introduction and overview

Under the New Regulatory Framework for electronic communications networks and services (NRF), National Regulatory Authorities (NRAs) must impose regulatory obligations on operators with Significant Market Power (SMP) in a market that is susceptible to ex-ante regulation. Similarly, existing regulatory obligations on operators who are not found to have SMP in a market where ex-ante regulation is appropriate must be removed.

Overall, the NRF pursues a de-regulatory agenda: the ultimate objective is, wherever possible, to move electronic communications services market to the point where sector-specific regulation can give way to the normal application of competition law. This is apparent from a number of key features of the NRF:

- In order to qualify for ex-ante regulation, a market has to meet the criterion that competition law remedies would not be sufficient to address competition problems that might arise in this market.
- The NRF is closely associated with competition law, and its use of competition law principles in the definition of markets and the finding of SMP. More specifically, SMP under the NRF is similar to the notion of market dominance under European competition law rather than, as in the previous regulatory framework, based on the application of a 25% market share threshold in markets that have been defined on the basis of criteria that did not necessarily reflect competitive constraints arising out of demand and supply substitution.

In order to achieve its objectives in the face of potentially significant differences in market conditions across Member States, which might require different regulatory measures across the EU, without distorting trade between Member States through inappropriate differences in regulatory policy, the NRF sets out procedures that NRAs have to follow before they can impose regulatory obligations:

- First, NRAs are required to undertake market reviews in order to establish where ex-ante regulation is required. Markets are defined

based on competition law principles (although relevant markets may differ from those that would be defined in a competition case because of the forward-looking nature of the market definition exercise required under the NRF). Regulatory obligations may only be imposed in markets that are characterised by high and persistent entry barriers, where market structure is such that one would not expect effective competition, and where competition law is likely to be insufficient to address problems of market failure. The starting point of the NRAs' market reviews is a list of markets identified by the Commission in its "Recommendation on Relevant Product and Service markets within the electronic communications sector susceptible to ex-ante regulation"¹, which has also been drawn up in order to ensure that all markets where regulatory obligations currently may exist will be reviewed by NRAs. NRAs can deviate from this list, subject to agreement by the Commission under the procedure set out in Article 7 of the Framework Directive.²

- Second, NRAs have to identify whether one or more operators are dominant in each of the markets under review. As noted above, the analysis required is similar to the analysis of dominance under competition law: a high market share usually creates the presumption of dominance, but further analysis of market share developments over time, barriers to expansion within the market and – somewhat problematically – the scope for vertical leverage of market power from another market have to be taken into account.³
- Having identified operators with SMP, NRAs must then impose at least one regulatory obligation on such operators. The Access Directive⁴ and the Universal Service Directive⁵ provide a list of obligations that may be imposed, but again NRAs can adopt different remedies where this is appropriate, provided the Commission has authorised the use of these

¹ C(2003)497 of 11 February 2003 (Commission Recommendation).

² Directive 2002/21/EEC of 7 March 2002.

³ This criterion is problematic for the following reason: if an operator is found to have SMP in a particular market because of vertical leverage from another market, this implicitly assumes that regulation will be ineffective in addressing the abuse of market power in the market from which it is leveraged. Otherwise, this reason for SMP would fall away once the firm under consideration is effectively regulated in the market from which leverage would otherwise take place.

⁴ Directive 2002/19/EEC of 7 March 2002.

⁵ Directive 2002/22/EEC of 7 March 2002.

remedies (following notification under Article 7 of the Framework Directive).⁶

The procedures for defining markets that may require ex-ante regulation, and for identifying operators with SMP are relatively well determined (not least because these procedures have been well established in the application of European and national competition law). Thus, one would expect a consistent application of the NRF across member States with regard to the first two steps.

By contrast, fewer clear-cut rules and much less established practice exist with regard to the choice of regulatory obligations and the adoption of remedies. This creates the scope for considerable variation in the application of regulatory policy across Member States, which in turn might have a detrimental impact on intra-community trade. It is the purpose of this paper to provide some guidance in the choice of remedy based on an analysis of the basic competition problems and market failures that require regulatory obligations in the first place.

The remainder of this document is structured as follows: Section 2 provides a high-level discussion of the generic problems that might arise in narrowband markets. Section 3 contains a general discussion of the economic principles that should guide the choice of remedies. A more detailed discussion of remedies for the various narrowband markets is provided in Section 4.

⁶ With regard to additional remedies, the Commission must either authorise or prevent the measure. Article 8(3) of the Access Directive states the following: *'In exceptional circumstances, when a national regulatory authority intends to impose on operators with significant market power **other** obligations for access or interconnection **than** those set out in Articles 9 to 13, it shall submit this request to the Commission. The Commission, acting in accordance with Article 14(2), shall take a decision authorising or preventing the national regulatory authority from taking such measures.'* (emphasis added).

2 Potential problems in narrowband

2.1 Narrowband markets

In order to identify problems that might potentially require regulatory intervention, it is helpful to start with a brief review of narrowband services. 'Narrowband' usually refers to communication links that have a limited bandwidth, generally defined implicitly through 'not being broadband'.

It might indeed be tempting to define narrowband services with regard to the maximum bandwidth supported. However, such a definition based on technological specifications does not necessarily capture substitutability on the demand (nor on the supply side), which forms the basis for the definition of markets in a competition law framework. In practice, any cut-off point chosen on the basis of bandwidth is likely to be arbitrary, and certainly at present varying definitions exist.⁷

Based on the competition-law approach to market definition, it is more helpful to start from the type of services typically provided over such connections. In this view narrowband services refer to 'plain old telephony services' (POTS), comprising access to the telecommunications network, various types of calls (local, national or international calls and calls to non-geographic numbers), fax and dial-up internet access⁸, i.e. circuit-switched internet access provided on demand (even if unmetered) as opposed to always-on connections provided through leased lines or xDSL links. These services have traditionally been provided by incumbent PTOs and other licensed operators (OLOs), including re-sellers, operators of long-distance networks and, where appropriate, cable operators offering a full range of telephony services. To the extent that services similar or identical to traditional voice services would be supplied over broadband infrastructure (e.g. using voice-over-IP), these services would likely to be in the same market, suggesting that the distinction between broadband and narrowband based on capacity is not decisive for market definition.

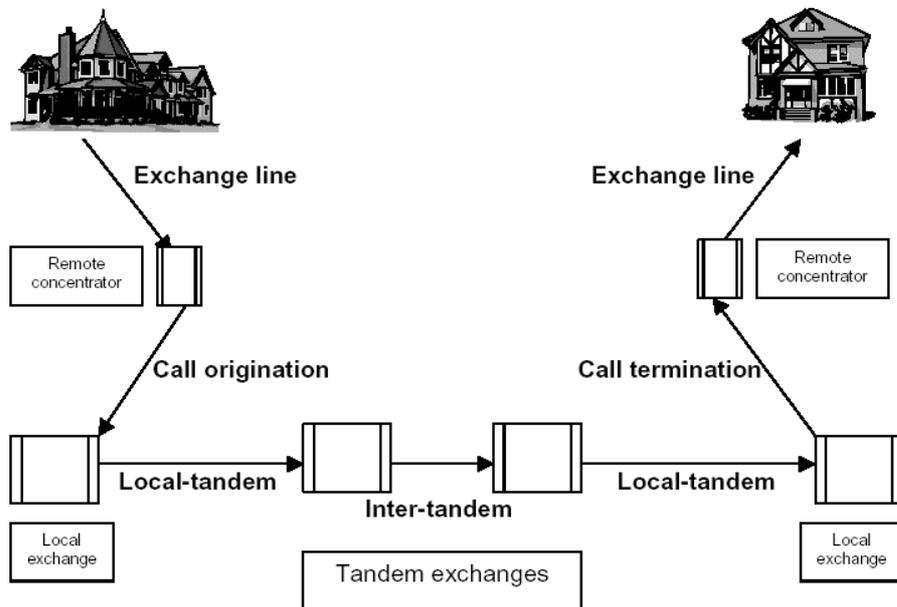
⁷ Newton's Telecom Dictionary (2001), for example, states that narrowband is an 'imprecise term' with cut-off points ranging from around 200 bits per second up to 1.544 Mbit/second. A recent OECD report (OECD, 2001) refers to the ITU-T Recommendation I.113, which defines broadband with reference to transmission capacities above primary ISDN (i.e. 1.5 or 2 Mbit/second), which would make anything below (and including) primary ISDN services narrowband services, but then uses a cut-off point of 256 kbit/second (in modification of the FCC definition of 200 kbit/seconds). OFTEL in the UK, for example, uses a cut-off point of 256kbit per second (see Oftel, 2003b)

⁸ This would imply an upper limit of 128 kbps, which would be achieved through channel-bonding using a basic ISDN connection supporting 2 circuits with 64 kbps each.

Traditionally, a distinction has been drawn between such services provided at fixed locations and mobile telephony services. With the growth in mobile penetration, the reduction in the cost of mobile services and the improvement in the data rates available through mobile networks (with the development of GPRS) this distinction has become increasingly questionable for the purposes of market definition.⁹ Nevertheless, the degree of fixed-mobile substitution is still considered to be insufficient for fixed and mobile telephony to be in the same market.¹⁰

The narrowband retail services listed above are provided over the Public Switched Telecommunications Network (PSTN). Figure 1 shows the basic structure of the PSTN.

Figure 1: The fixed narrowband network



Source: Oftel, 2003a

⁹ For empirical evidence on the substitution between fixed and mobile telephony see Horvath and Maldoom (2002), or Sung, Kim and Lee (2000). Of course, the question from a market definition perspective is whether the degree of substitution is significantly strong to make a small but significant non-transitory increase in price by a hypothetical monopolist of fixed voice telecommunications services unprofitable.

¹⁰ It is worth pointing out that the Commission Recommendation does not devote much (if any) consideration to the degree of substitutability between fixed and mobile telephony. Whilst this may be understandable given the need to provide an interface between the markets as defined under the old framework, and markets under the NRF defined on the basis of competition law principles, it may well be appropriate to abandon the separation of fixed and mobile markets from a forward-looking perspective.

A distinction can be drawn between the access network, linking individual customers' premises to the local exchange¹¹, and the core network linking individual local exchanges and national and international switching centres (tandem exchanges). In very broad terms, the main difference between the access and the core network is that network capacity in the access network is dedicated to individual customers, whereas capacity in the core network is shared.

This implies that economies of scale and scope are significant in the access network, but less so in significant parts of the core network (depending on the volume of traffic carried over a particular link). Thus, the potential for competition in the provision of links between an individual customer's premises and the local exchange (the local loop) is usually limited: unlike in the core network, facilities-based competition in the local access network is more difficult to sustain, and potentially much less desirable owing to the duplication of fixed costs associated with the competitive provision of traffic-insensitive links connecting individual customers to the network, unless supported by other services (such as multi-channel television services offered through cable networks) that give rise to economies of scope.

Use of the local loop is an essential input in the provision of any narrowband service: originating a call requires use of the local loop connecting the calling party to the network, and, in the case of calls to geographic numbers completion of the call requires the use of the local loop connecting the called party.

Historically, narrowband services have been provided by vertically integrated, state-owned monopolies, which have run the network and provided a full range of services to customers. This has changed as a result of market liberalisation, supporting the development of competing networks and service providers through a range of regulatory interventions:

- Indirect access (or carrier selection – CS) and carrier pre-selection (CPS)¹² obligations ensure that customers can obtain call services from providers other than the access provider.
- Vertically integrated incumbents are often required (but also sometimes choose) to offer services on a wholesale basis to re-sellers (or service providers), who then serve the end customer. Such wholesale supply can cover the full set of telephony services (e.g. BT's Calls & Access

¹¹ “[A]ccess is the part [of the network] from the customer premises to the first switch” (Laffont and Tirole, 2000, footnote 9, page 13). Alternatively, the definition of the access network may exclude the switch, but cover the distribution frame within a local switch, or a frame outside a local switch from where an alternative local operator could connect customers to its own switches and network.

¹² Note that NRAs are required by the Universal Services Directive to impose an obligation on SMP operators to provide CS and CPS, to ensure that charges for the provision of access and interconnection necessary for CS and CPS is cost oriented and that direct charges to subscribers do not act as a disincentive.

product) or only particular types of services (e.g. international resale). This has created wholesale markets.

- Interconnection obligations enable competitors who have invested in their own networks to offer services to customers connected to the incumbent's network (by being able to purchase call origination and call termination services and, where required, conveyance) as well as to customers connected to their own networks (by being able to obtain call termination on the incumbent's network as necessary to complete calls originated by their customers and, where required, conveyance). This has created markets for network services.¹³

Table 1 shows how the various markets contained in the Commission Recommendation cover the narrowband services discussed above. This indicates that the Commission Recommendation does not include wholesale services offered for pure resale.

¹³ Being provided to telecommunications operators rather than to end customers, network services are also wholesale services, but in order to maintain a distinction between the wholesale equivalent of a retail service and a network service which needs to be combined with other network services in order to produce a retail service, I will use the term **wholesale service** for the former, and **network service** for the latter.

Table 1: Services and markets identified in the Commission Recommendation

Type of service	Market in Commission Recommendation	Potential further distinctions
Retail access	Access to the public telephone network at a fixed location for residential customers	Different types of access (analogue/digital)
	Access to the public telephone network at a fixed location for non-residential customers	
Retail call services	Publicly available local and/or national telephone services provided at a fixed location for residential customers	International markets by country pairs Calls to non-geographic numbers
	Publicly available local and/or national telephone services provided at a fixed location for non-residential customers	
	Publicly available international telephone services provided at a fixed location for residential customers	
	Publicly available international telephone services provided at a fixed location for non-residential customers	
Network services	Call origination on the public telephone network at a fixed location	Different types of conveyance including/excluding switching
	Call termination on individual public telephone networks provided at a fixed location	
	Wholesale unbundled access to metallic loops and sub-loops for the purpose of providing broadband and voice services	
	Transit services in the fixed public telephone network	
Wholesale services	N/A	

2.2 What are the problems in narrowband?

2.2.1 Limited network competition in the local loop

Even though telecommunications markets in all Member States have been fully liberalised and open to competition for at least four years, the entrenched position of former (state-owned) monopoly operators has persisted in many areas. Competition is not fully effective with regard to all narrowband services. In particular in the provision of access services to residential customers incumbent operators have maintained a strong position.

This is largely because in many Member States very little has been invested in the roll-out of alternative access networks to connect residential customers: even though large-volume business users in central urban areas may have a

choice of access providers, for many residential customers (in particular in rural areas) the former PTO is the only provider of fixed access.

Where alternative access networks have been rolled out, this has been driven to a large extent by their ability to provide services other than voice telephony – mostly multi-channel TV delivered through cable networks. Table 2 shows the number of access lines and the number of cable connections for a number of EU Member States.

Table 2: Access lines and cable connections in the EU

	No. of access lines (000s)	No. of homes passed by cable (000s)	Proportion of homes passed by cable
	2002	2002	1999
Austria	3,097	2,000	53%
Belgium	4,775	n/a	100%
Denmark	3,074	1,770	70%
Finland	1,975	n/a	63%
France	38,931	11,530	32%
Germany	52,200	n/a	86%
Greece	5,437‡	n/a	0%
Ireland	1,962	1,000	50%
Italy	28,540	2,500	5%
Luxembourg	354	n/a	100%
Netherlands	7,875	n/a	94%
Portugal	4,234	3,361	47%
Spain	16,214	2,093	8%
Sweden	6,441	n/a	65%
United Kingdom	35,172	13,318	51%

‡1999, not 2002

Sources: *Informa World Broadband Database, May 2003 (all 2002 data)*;
OECD Communications Outlook, 2001 (all 1999 data)

This shows that considerable variation exists across the EU with regard to cable roll-out. Moreover, one needs to bear in mind that cable connections are not synonymous with access to narrowband services: in many cases, cable was deployed primarily as a broadcast infrastructure, thus lacking a return path. Such cable networks would generally not be capable of providing switched telecommunications services (or indeed two-way broadband data connectivity) without potentially very costly upgrading

Alternative access technologies such as wireless local loop have not had much success to date (other than perhaps in some niche applications). Although an increasing range of wireless access technologies are being developed (for example, wireless LAN technology using the 802.11x standard being deployed in public hotspots), their deployment appears to be driven mainly by the desire to provide broadband data connectivity rather than to establish an alternative method of delivering POTS. Of course, the increasing use of voice-over-IP solutions down to the customer terminal may ultimately mean that all these access infrastructures compete in the provision of voice services, further suggesting that the distinction between narrowband and broadband infrastructures is largely irrelevant for the purposes of market definition.¹⁴

This means that, despite the introduction of measures to facilitate customer switching (such as, for example, number portability¹⁵), incumbent operators have retained market power in the provision of access to end customers, in particular residential customers. By implication, this means that they have retained market power in the provision of call origination and termination services to other network operators with whom they are competing in the provision of call services (including fax and dial-up internet services).

As any service provided to the end customer uses the access network, control over access to customers raises competition concerns at the level of retail services and with regard to the provision of wholesale services to service providers and network services to competing network operators.

The most obvious form of exploiting market power in the provision of access would be to set high retail prices for this service (perhaps even inviting competitors into the provision of call services in order to increase demand for access¹⁶). However, traditional pricing of telecommunications services in line with a universal service objective and regulatory restrictions on retail prices put in place following privatisation and market liberalisation mean that this is not the case. Despite efforts to re-balance tariffs, an access deficit (resulting from retail prices for access being below costs) may still persist.

If network charges were not subject to regulatory control, the access monopolist could instead increase its tariffs for call origination and call termination. The monopoly over access to customers would then be exploited

¹⁴ Of course, this raises the question to what extent VoIP solutions using alternative infrastructure should already be considered in the assessment of SMP under the heading of potential competition. At present, the main impediment for the roll-out of VoIP solutions appears to be the cost of terminal equipment. However, this could reduce dramatically to the extent that rapid take-up allows manufacturers to exploit economies of scale.

¹⁵ The Universal Services Directive requires NRAs to ensure that number portability is available for both geographic and non-geographic numbers on fixed and mobile networks.

¹⁶ The incentives to invite competitors in the provision of a complementary service have been analysed by Economides (1993).

by charging customers more for the services they receive, either through higher call charges or through charging those wishing to gain access to these customers (i.e. competing network providers).

At first sight, the only problem would appear to be one of excessive pricing, without the access monopolist aiming to restrict or distort competition in related markets. For example, the incumbent would have strong incentives to supply network services (at monopoly prices) whenever competing operators are more efficient in the provision of call services than the incumbent itself. Similarly, the incumbent could benefit from the improved efficiency of service providers by supplying wholesale services (at monopoly prices).

However, imposing regulatory constraints on network charges changes this.¹⁷ To the extent that it has to supply call origination and call termination to competing network operators (and, perhaps, wholesale services to service providers), in the presence of CS/CPS obligations the incumbent would be unable to sustain high call charges. The incumbent has therefore an incentive to restrict or distort competition it faces from other network operators (and re-sellers) in serving final customers.

Given that customers generally buy a bundle of (complementary) services consisting of access and various call types, and that the access provider supplies crucial inputs to others with whom it competes in the provision of call services, there is a range of strategies that can be used in order to leverage market power in the provision of access into the provision of calls:

- At the retail level, the incumbent might engage in bundling of access and call services in a way that discourages its access customers from obtaining call services from other providers, thus trying to undermine

¹⁷ It is worth pointing out that even in the absence of network charge regulation, this simplistic view does not necessarily hold. The access monopolist may, in practice, be unable to commit to a certain output, and may therefore be unable to extract the maximum profit from its wholesale customers, i.e. other network operators purchasing call origination and termination services, or re-sellers buying wholesale services. Therefore, the access monopolist might have an incentive to limit and distort competition in the provision of call services.

For an exposition of this argument see Rey and Tirole (1997): an upstream monopolist in general cannot fully exert its monopoly power without engaging in exclusionary practices. Therefore, if the monopolist cannot fully commit to supply just the monopoly level of inputs, monopoly profits cannot be obtained in the upstream market and therefore some market power will 'spill-over' to the downstream market. Moreover, this spill-over is larger the more competitive is the downstream market as commitment becomes even more difficult. Vertical restraints and foreclosure strategies can be interpreted as an attempt to deal with this problem.

the effects of CS and CPS obligations.¹⁸ For example, the incumbent might offer a bundle of free or heavily discounted call minutes with its line rental in exchange for a higher access charge, which might make its own offering more attractive than the alternative of buying calls from an CS or CPS operator. In addition, the incumbent might try to increase customer switching costs e.g. by requiring customers to sign long-term contracts if they want to take advantage of particular offers. Bundling might also be used in order to carry incumbency advantages in the provision of narrowband services over into the broadband services market, e.g. by offering low-price bundles of narrowband and broadband services.

- At the wholesale level, the incumbent might increase the cost to competitors of network services or wholesale services for re-sale, thereby reducing the margin available to them from providing call services. Even if the price terms of wholesale provision were regulated in order to prevent such a strategy, the incumbent might use non-price terms in order to raise the cost of its competitors in the provision of call services. Laffont and Tirole (2000) identify a number of exclusionary strategies that might be used by an incumbent in the case where the 'bottleneck segment' – i.e. network services provided through the access network – is tightly regulated while other segments might be more loosely regulated. These include:
 - refusal of, or delay in providing interconnection;
 - refusal to unbundle network services, which might require competitors to purchase elements they do not require, thereby raising their costs;
 - requiring competitors to comply with particular standards, or use particular types of equipment, which might raise rivals' costs relative to the level they would have to incur if they were able to use the most efficient alternative; or
 - requiring competitors to disclose information that would allow the incumbent to pre-empt particular competitive strategies (e.g. advance notification of demand developments).

From a regulatory perspective, the problem with the last three of these strategies is that there may well be genuine efficiency reasons for not unbundling network services, that requirements to use particular

¹⁸ Note that further reasons might exist for the incumbent to try and bundle calls and access. Nalebuff (2003) lists a number of reasons for which a monopolist in the provision of one good might want to engage in bundling this with complementary and potentially competitive goods. These include price discrimination (referred to as 'metering'), attempts to prevent entry into the currently non-competitive segment by restricting market opportunities for rivals in the competitive segment, combining market power in both segments to greater effect, and pure efficiency reasons in the presence of economies of scope.

standards or equipment may be justified in order to maintain system integrity, and that advance information may need to be provided in order to assist, for example, capacity planning. This makes regulating such behaviour difficult, and there is always the risk that regulatory intervention causes welfare losses in the same way as failure to act can leave welfare gains unexploited.

2.2.2 Thin routes

The development of infrastructure competition in the core network has been possible because scale economies are much less pronounced in conveyance services where capacity is shared. However, this is not necessarily true across the entire core network. There may be connections on which the volume of traffic is small relative to the minimum efficient scale, and therefore scale economies are pronounced. Although growing traffic volumes should reduce the number of such 'thin routes' over time, whilst traffic volumes are small relative to installed capacity, the presence of scale economies in combination with sunk costs means that the incumbent may face little or no competition in the provision of conveyance services on these routes. This may create market power in sub-segments of the core network, i.e. in the provision of conveyance services between particular points (such as, for example, backhaul from rural exchanges). Similar to market power over access to customers, there may be an incentive to use control over conveyance on some routes in order to restrict or distort competition in other parts of the network or in the provision of retail services.

While the presence of significant scale economies in parts of the core network may often simply be the result of traffic volumes being below the minimum efficient scale of the corresponding network link, they may also be the outcome of strategic over-investment by the incumbent operator: as Spence (1977) and Dixit (1980) have demonstrated, investing in over-capacity can deter entry and allow an incumbent operator to retain (and exploit) market power. Although the expectation of being subject to regulation would reduce the incentives for strategic over-investment, the inherent imperfection of regulation implies that it might not be completely eliminated.

Establishing whether a certain amount of over-capacity is the result of strategic investment to deter entry is, unfortunately, far from straightforward. Given the high fixed costs of building network infrastructure, it may well be commercially rational to invest in significant excess capacity even if there is only a small probability that demand to fill this capacity will materialise. Thus, some investment strategies may have the unintended effect of deterring future entry.¹⁹

¹⁹ In this context, it is worth noting that regulatory problems can arise from predicted demand failing to materialise. For example, there may be significant amounts of overcapacity in many parts of the network as a result of the investment boom in the late 90s.

In this case, however, pricing strategies that might look superficially very much like predation should not raise concerns: the purpose of strategic over-investment to deter entry is to lend credibility to the threat of price cuts post entry while allowing the investor to maintain high prices in the face of significant under-utilisation. By contrast, low prices in the face of over-capacity are likely to be motivated by the capacity owner's attempt to fill capacity that is available at little or no additional cost. Thus, it is the combination of over-capacity and high rather than low prices that would indicate potentially anti-competitive behaviour.

2.2.3 Lack of liberalisation in other countries

Another problem that might arise in the context of international call services (in addition to some international routes being thin routes) is the lack of liberalisation in other countries. Where such liberalisation is lacking, only the incumbent PTO (based on historic correspondent agreements) may be able to supply international calls to a particular country as it is the only party interconnecting with the foreign PTO. For example, Oftel (2003) has identified a number of international markets (on a country-pair basis) where, based on a number of criteria, BT or Cable & Wireless continue to enjoy a dominant position.

Market power in the provision of calls to particular international destinations could again be leveraged because, for example, a CPS operator would not be able to offer international calls to all possible destinations without relying on the wholesale supply of international calls to a subset of destinations from the incumbent.

2.2.4 Incumbency advantages from existing customer relationships

In many markets, incumbents have an advantage over new entrants to the extent that small switching costs result in customer inertia. Information about usage patterns and price responsiveness may create an advantage in terms of designing new products and tariff packages for incumbent operators. In addition, existing customer relationships, in combination with information obtained about entrant's business strategies as a result of interconnection or CPS requests may provide incumbent operators with opportunities to target those customers that are most likely to switch to another provider.

2.2.5 Call termination

Call termination is similar to call origination in the sense that it is an essential input required by any operator wishing to provide call services. However, call termination raises a number of additional issues which, unlike the concerns about call termination, would not disappear even if facilities-based competition in the provision of access were to emerge and become effective.

This is because competition between access networks would bring pressure to bear on the provision of call origination, but not on termination owing to the 'calling party pays' principle governing the pricing of telecommunications services across Europe. Where raising charges for origination would

discourage potential access customers from signing up with a network operator in the first place (as this would tend to increase the price of making calls), an increase in termination charges has no such effect. Higher termination charges would only impact on the price of incoming calls, which is paid by the caller rather than the party receiving the call (and having chosen the network). As raising termination charges increases the price of calls faced by subscribers to **other** networks, call termination is not subject to the same competitive constraints as origination.²⁰ Even where competition in the provision of access to customers is effective, call termination remains a “competitive bottleneck”²¹. Perhaps paradoxically, the incentive to exploit control over access to customers through high termination charges increases with the intensity of competition for subscribers – thus, the call termination problem may be more pressing the more intense retail competition.

In addition to not being subject to the same competitive constraints as call origination (and outgoing call charges), termination charges can be used in order to affect competition at the retail level. This is because through setting termination charges, competing network operators affect each others’ costs – termination gives rise to a two-way access problem.

For example, termination charges might be used to soften retail competition, as can be shown in a simply stylised example.

Suppose that there are two networks A and B with x_A and x_B subscribers respectively. Assume that, at given call prices, each subscriber makes calls lasting m minutes per month, and that each subscriber is equally likely to call any other subscriber so that the proportion of traffic destined for the subscribers of each network is determined by the relative network size.

Thus, the traffic generated by subscribers on network A is $m \cdot x_A$, of which a proportion $\frac{x_A}{x_A + x_B}$ are call minutes to subscribers on the same network, and

the remainder are terminated on network B. Thus, the total amount of traffic flowing from network A to network B is $\frac{m \cdot x_A \cdot x_B}{x_A + x_B}$. Applying the same

reasoning to network B shows that the same amount of traffic is flowing in the opposite direction, i.e. the number of minutes originated on network B and terminated on network A is $\frac{m \cdot x_B \cdot x_A}{x_A + x_B}$. The traffic flow between the two

networks is perfectly balanced, and provided that termination charges are identical, payments and revenues cancel out.²² This could be taken to

²⁰ Both the implications of CPP and the role of termination charges have been discussed in the context of regulating termination charges on mobile networks (see, for example, Armstrong 1998 and 2002, or Gans and King 2000).

²¹ Armstrong (2002a)

²² Note that this holds irrespective of the relative network size x_A/x_B .

suggest that network operators are completely indifferent about the level of termination charges, provided they are reciprocal. However, higher termination charges can help to sustain higher retail prices by providing a built-in punishment mechanism for deviations from a collusive retail price level.

If either of the networks were to reduce its call charge in order to attract more customers, this would result in an imbalance of traffic flows, and this imbalance has revenue implications that increase with the termination charge. Assume, for example, that network A were to attempt to compete by reducing the call price, and that as a result customers on its network made more calls, say $n > m$ per month. This would imply that traffic flowing from A to B would

increase to $\frac{n \cdot x_A \cdot x_B}{x_A + x_B}$, which implies that with unchanged calling behaviour of

customers on network B there is now a net flow of $\frac{(n - m) \cdot x_A \cdot x_B}{x_A + x_B}$ minutes

per month from network A to network B. This generates net outpayments that are higher the higher the termination charge. Winning customers by reducing the price of calls in this case can be costly, and can be made more costly by increasing termination charges.

Of course, in practice the impact of higher termination charges on retail competition is more complicated than in the stylised example for a number of reasons. For example:

- network operators have more than one price they can change (assume, for example, that A could attract customers by reducing a subscription charge, which does not impact on calling patterns. In this case the above effect would be absent);
- network operators differentiate between on-net and off-net prices (assume, for example, that A could attract customers by lowering on-net charges, stimulating only calls on its own network but leaving cross-net calls unchanged); or if
- the customers of different networks are different with regard to their calling patterns.

However, in the presence of tariff-mediated network externalities (i.e. where operators differentiate between off-net and on-net charges) or differences in calling patterns (e.g. where new entrants aim primarily to attract high users) termination charges can distort competition between incumbents and new entrants:

- Higher termination charges increase the price difference between calling subscribers on-net and calling them cross-net. This would give larger incumbent networks an advantage over new entrants, for whose subscribers a larger proportion of calls would be cross-net.
- If new entrants are likely to target customers who are particularly high/low users, successful entry will lead to a net inflow of traffic for the incumbent/new entrants, and a higher/lower termination charge makes entry more difficult.

Potential problems in narrowband

A further issue related to termination that might arise is linked to the fact that entering into individual interconnection agreements may cause substantial costs that are fixed with regard to the traffic volume carried between the interconnecting operators. Where there is a large number of small operators of access networks (e.g. different providers of local access in different regions), it may not be feasible for each of the individual small operators to enter into agreements with all others about termination of calls to their respective subscribers. In this case, the incumbent PTO may be the only operator having interconnection agreements with all the smaller access network operators, and therefore in a position to guarantee termination to any customer connected to the network. Smaller operators might benefit from having access to the incumbent's network of interconnection agreements, whilst the incumbent may have an incentive not to provide such access (or provide it at terms and conditions that are prohibitive).

3 Considerations in the choice of remedies

The Access Directive and the Universal Services Directive contain a list of obligations that may be imposed on operators with SMP in wholesale and retail markets respectively, but also provide for NRAs to impose obligations not explicitly listed, subject to approval by the Commission. In any case, NRAs need to demonstrate that the chosen remedy is appropriate for the problem identified, proportionate (which generally implies that it does not impose obligations in excess of what is necessary in order to address the problem identified), and justified in the light of the basic regulatory objectives of promoting competition, contributing to the development of the internal market, and promoting the interest of citizens.

These general principles require an assessment of the economic effects of remedies, both those that are intended and aimed at solving a problem identified by the NRA as well as unintended side-effects of regulatory intervention.

The objective of promoting competition would appear to suggest that remedies should, wherever possible, be aimed at targeting the causes of ineffective competition (e.g. behaviour that distorts competition in a particular market) rather than its symptoms (e.g. higher prices as a result of such distortions). This clearly implies removing entry barriers that are caused by legal restrictions or regulation itself.

Where entry barriers are structural (e.g. arising from a combination of sunk costs and strong scale economies, or exogenous customer switching costs), regulation needs to ensure that the resulting market power is not exploited, focussing in particular on the scope for behaviour that restricts or distorts competition in related markets.

Proportionality would also suggest a requirement for NRAs to take account of inevitable imperfections in their application of regulatory policies. Whilst it is generally easy to state, for example, that access charges should be set at cost, in practice it is often difficult to establish with any degree of precision the level of relevant costs. Given the (potentially considerable) scope for error, it is important to consider the risks associated with setting regulated charges too high or too low against the potential downside of not interfering at all. Similarly, some practices that could potentially be motivated by anti-competitive objectives, or have the effect of restricting or distorting competition in related markets (such as, for example, bundling), may also have a perfectly innocuous motivation and may actually increase efficiency and improve welfare. The risk of restricting behaviour that is actually welfare-enhancing also needs to be taken into account in establishing whether a particular measure is proportionate.

3.1 Impact on investment incentives

If the underlying regulatory objective is to promote self-sustaining competition that does not rely on regulated access to an uncompetitive

network infrastructure, the most important consideration is the impact of regulation on investment by potential competitors who face a 'make-or-buy' decision.

This is complicated by the fact that access to existing network infrastructure on regulated terms can be both a substitute for, and a facilitator of investment in competing networks. For example, new entrants may start off as pure re-sellers of an incumbent's service, building their customer base and then gradually replacing reliance on the incumbent's infrastructure with investment in their own networks. This would suggest that new entry is easier the lower access charges to the incumbent's infrastructure. However, in order to provide the correct incentives eventually to replace access with own investment, access charges must not be too low, i.e. the entrant must not be allowed to free-ride on the incumbent's investments.

The ultimate make-or-buy decision depends on the regulated access charge relative to the cost of investing in own infrastructure. Two fundamental problems exist in this context:

- From a theoretical perspective, even small economies of scale and scope imply that competition between network infrastructures would ultimately result in efficiency losses *relative to a situation of perfect access regulation*. In this case, there is a strong tendency to classify investment in infrastructure as 'inefficient bypass'. However, in practice, access regulation is never perfect, and competition may bring benefits that are not reflected in the impact of facilities-based entry on unit costs. This implies that regulating on the basis of principles that are first and foremost intended to prevent inefficient by-pass and duplication of infrastructure may be highly inappropriate.

This suggests that the established principles of cost based regulation – setting regulated charges on the basis of long-run incremental costs, using forward looking costs and assuming modern equivalent assets in order to avoid inefficient bypass – are likely to provide insufficient investment incentives to new entrants, taking account of the wider social benefits associated with facilities-based competition. Unless a new entrant can expect to achieve the same scale as an incumbent (and offer the same scope of services as the incumbent), any regulated charge that only allows cost recovery for the incumbent (assuming it

were efficient) will be lower than the likely unit cost if the new entrant were to invest.²³

- Even if a new entrant could achieve a unit cost below the regulated access charge by making its own investment, regulation can give rise to an asymmetry between incumbents and new entrants in terms of the way they are affected by uncertainty of market developments.

It is generally accepted that, in order to provide appropriate incentives for investment to the regulated incumbent, regulated charges need to be set such that the firm can recover its investment costs (including a sufficient return on capital). For example, if as a result of CS and CPS obligation access providers were to lose their entire calls business, regulated origination and termination charges would need to allow them to recover their investment in the access network (also taking account of access charges collected from retail customers). Using forward-looking cost concepts on the basis of modern equivalent assets in the determination of cost-based regulated charges is generally regarded as appropriate to ensure that the incumbent is in the same position as a new entrant making a similar investment using modern technology. This then suggests that entrants who are more efficient than the incumbent would make their own investments, whereas less efficient entrants would buy access from the incumbent, and equally efficient entrants would be indifferent.

However, this ignores that the availability of network services from the incumbent provides an option to new entrants for delaying their investment. As has been shown, such an option can be extremely valuable in the presence of sunk costs and uncertainty over market

²³ The estimate of scale economies used by regulators in order to establish the likely decrease in unit costs associated with volume growth suggests sizeable scale economies. In the mid 90s, Oftel used to use cost-volume elasticities (CVEs, for operating costs) and asset-volume elasticities (AVEs, for capital expenditure) as low as 0.43 – 0.45 when setting BT's network price cap. These elasticities measure the percentage increase in cost for a one percent increase in volumes. The smaller their value, the larger are economies of scale. A more recent study prepared by Europe Economics for Oftel suggests cost-volume relationships (CVRs) for symmetric broadband origination in the access network of 5% for duct (i.e. if volume doubles, the cost for ducting increase by 5%), 35% for copper, 22% for fibre and 48% for operating costs (see Oftel (2003d), p 249, paragraph B.188.). Overall, this suggests that the unit costs faced by an entrant serving one-third of the market could be twice as high as the unit cost faced by the incumbent.

developments, some of which will resolve over time.²⁴ This implies that new entrants may not be willing to make an investment, or invest with a considerable delay, if they have the alternative of obtaining access to the incumbent's network, even though they are potentially more efficient than the incumbent. The Annex provides a stylised example of the impact of option values on investment decisions. For the avoidance of doubt, it is worth noting that the issue at hand is not that an option exists for the regulated incumbent, but for the entrant. If the value of this option is not priced into the access charge, make-or-buy incentives are affected in a way that discourages investment in favour of obtaining access on regulated terms.²⁵

Unfortunately, there is no easy solution for addressing the built-in bias against new infrastructure investment. There is no hard and fast rule for adjusting access charges in order to address these issues other than that trying to regulate out of the system rents that accrue to the incumbent because of its scale (as a result of scale and scope economies) or of its having made many of the sunk investments (and thus having given up the option values enjoyed by new entrants) will discourage new investment in infrastructure: even though low access charges may initially facilitate entry, they may provide insufficient incentives over time to replace access bought at regulated terms with own investment.

A recent survey of access pricing issues concludes that, even in a simple framework that does not address the cost of regulation and the potential measurement problems *"the pricing issues have not been solved. Access and interconnection pricing can only be appraised in the wider context of the regulation and competition of the market as a whole. For example, the properties of the now-famous Baumol-Willig (ECPR) rule are different when*

²⁴ For a discussion of the role of option values in investment decisions see Dixit and Pindyck (1993). For an application to telecommunications regulation see Hausman (1998). Economides (2000) argues that option values are not relevant for the pricing of network elements because, amongst others, real options theory "assumes that the ILEC will remain a monopolist and has the luxury of putting off investment." However, this misses the point that new entrants, who have a choice between investing and purchasing network services at regulated prices will take account of option values, and that setting access prices at levels that exclude option values affect their make-or-buy decision.

²⁵ It is worth pointing out that these arguments hold even if there are first-mover advantages at the retail level (i.e. benefits from quickly building up a customer base). Customers do not generally care about whether a service is provided over the entrant's own infrastructure or through regulated access.

Of course, one could conclude from the existence of an option value associated with buying access at regulated terms that new entrants are less efficient because they face more risk than incumbents. However, this would suggest that there is a natural monopoly for risk-bearing, putting the incumbent in a favoured position relative to any new entrant. This view may well be appropriate if the alternative to competition is a perfectly regulated monopoly, but is incompatible with the objective of supporting the development of sustainable and effective competition.

*there is a retail price cap than without it. It is critical for the special treatment of access pricing that there are natural monopoly elements in the network. Where these are absent or bypass is broadly viable access pricing will pose competition concerns only for special cases. These properties, however, are largely unknown to the regulator. One function of access charge rules therefore has to be to provide the right incentives for facilities-based competition and bypass. This involves an assessment of innovation and dynamic aspects that the current access pricing literature does not provide."*²⁶

The lack of general results suggests that NRAs will have to form an opinion about the relative importance of maintaining investment incentives, preventing inefficient bypass, obtaining dynamic benefits from infrastructure based competition and ensuring efficient use of existing infrastructure. An important factor in this is the extent to which replication of infrastructure is considered to be feasible and desirable, i.e. a view on the strength of scale economies (and the extent to which there may be economies of scope with other services that might sustain competing infrastructures). Even though economic theory can provide some guidance, it cannot ultimately replace the inevitable judgment that NRAs have to make on these issues. Access charges do affect investment decisions, and it would be inappropriate to pretend that the problems outlined above do not exist.²⁷

Some insight may be gained, however, from looking at unregulated industries where option value issues arise, and where these issues are reflected in the terms and conditions of privately negotiated agreements. For example, terms and conditions agreed for long-term supply contracts are often considerably better than those available for short-term agreements. This difference may partly be explained by the existence of fixed costs associated with negotiating the agreement that need to be recovered over the period of the agreement. However, in particular where the supplier needs to make sunk investments in order to meet its obligations, these differences reflect the presence of an option value associated with the short-term agreement. By entering into a long-term commitment, the buyer gives up these option values, and obtains often considerably lower prices. From the supplier's perspective, offering better terms is justified because of the reduced risk of being left with stranded assets.

²⁶ Vogelsang (2003), p 46.

²⁷ It is beyond doubt that access charges affect investment decisions. The example of facilities-based entry in urban areas (e.g. Germany's city carriers), which may be used to suggest that LRIC-based access pricing does not discourage entry, is a case in point: in the presence of geographically averaged access charges and geographic cost differences, one would expect to find facilities-based entry in areas with less-than-average cost, but not in areas where costs are above average. Of course, this does say nothing about the relative efficiency of entrants, as entrants in low-cost areas would be better off investing than buying access even if their cost of doing so were in excess of the incumbent's, but below the averaged access charge.

A similar differentiation in the terms and conditions of providing network access appears to be an obvious way of addressing option value issues and addressing investment incentives. An access pricing regime that provides for differentiated terms and conditions reflecting the degree of commitment entered into by the access seeker (and, consequently, the risk of stranded assets faced by the access provider), should be better suited for providing the correct incentives than standard access terms that apply to all types of access agreements. Facing higher prices for short-term access agreements and consequently better terms for a long-term commitment, the access seeker's make-or-buy decision should be based on a proper assessment of the relative costs and benefits, and not affected by the 'free' wait-and-see option that would otherwise be available.

3.2 Implementation problems

In addition to unresolved conceptual questions, a significant problem of regulatory policy is the lack of information available to the regulator on cost and demand conditions, which is essential for the setting of regulated charges.

3.2.1 Cost issues

Cost benchmarks are widely used in the identification of a problem that might require regulatory intervention: a difference between prices and some notion of underlying costs is taken as an indication of market power. This procedure is based on the assumption that in a competitive market prices correspond to costs. Unfortunately, this assumption does not necessarily hold where competition takes place over a bundle of services which are provided subject to economies of scale and scope. In the presence of fixed and common costs, competing firms will structure their relative mark-ups in response to demand conditions.

The same problem arises when a regulator has to set appropriate charges for individual services. Setting such charges at the level of incremental cost (LRIC being often used as a proxy for marginal cost) would not allow the regulated firm to recover fixed and common costs, so that mark-ups are required. Although it is generally accepted that such mark-ups should be determined in line with Ramsey pricing principles in order to minimise the inevitable welfare loss from having to charge above marginal cost, the informational requirements are considered to rule out such pricing, and equi-proportionate mark-ups are used instead. This introduces inefficiency, and it is not necessarily the case that regulating charges at such a level will increase welfare relative to the unregulated outcome.

The need for mark-ups is, of course, related to the definition of incremental cost. In the presence of economies of scale and scope, any measure of incremental cost will depend on the increment considered:

- Economies of scope mean that the incremental costs associated with the provision of a particular services depend on what other services are being offered.

- Economies of scale imply that the additional costs associated with increasing the output of a particular service by a certain amount depends on the volume of that service already being offered.

The smaller the increment, the smaller the corresponding incremental costs and the greater the impact of the way in which fixed and common costs are being recovered. The use of larger increments (e.g. full-service increments) only masks this problem, but does not solve it – in order to determine the costs of larger increments, it is often necessary to allocate fixed and common costs to the service in question, and the resultant cost figures move towards those that would be obtained from a fully allocated cost model.

Perhaps an even more basic problem arises in the quantification of costs. The debate about the relative merits of bottom-up and top-down cost models provides ample evidence for the fact that establishing costs associated with the provision of particular services is difficult. Bottom-up models tend to ignore the fact that investment has been undertaken incrementally in little steps, and that what might appear as inefficiency from the perspective of a scorched node cost model might actually simply be the impact of history. The irreversible nature of investment decisions generally implies that existing networks have legacy systems often operating less efficiently than if the entire network (maintaining its basic topology) were rebuilt from scratch with the latest modern technology. By contrast, top-down approaches tend to err in the other direction, not being able to identify clear inefficiencies in the operation of the regulated firm.

However, establishing costs on the basis of modern equivalent assets (MEA)²⁸ may be particularly problematic where innovation is intense and technological improvements can result in a potentially dramatic reduction of the cost of building and operating a network. A constant re-valuation of an incumbent's network on the basis of MEA may result in a situation in which the incumbent cannot ultimately recover its investment, unless economic depreciation (which reflects the change in replacement costs) is appropriately taken into account. There must at least be a question mark over the extent to which depreciation schemes used in practice accomplish this objective.

3.2.2 Demand issues

With regard to bundling strategies at both the retail and the wholesale level, assessing whether a particular form of behaviour amounts to an attempt to leverage market power is complicated by the fact that such behaviour may also arise for various efficiency reasons. Bundling can be equivalent to price

²⁸ "The MEA is the lowest cost asset which serves the same function as the asset being valued. It will generally incorporate the latest available and proven technology and is the asset which a new entrant might be expected to employ. In a world in which technology is changing rapidly, it is quite likely that, for some assets, the MEA will differ from the asset that an incumbent currently has in place." (see Oftel 1997, paragraph 3.4)

discrimination, the welfare effects of which are ambiguous. In addition, it can simply be the result of underlying scope economies, in which case regulatory attempts to ban or restrict bundling would have a detrimental effect on customers.

A stylised example of bundling practices which can increase output and overall welfare, but also make it more difficult for new entrants to come into the market, may be helpful to understand the issues.

Assume that there are three types of customers (A, B and C) who differ with regard to their valuation of ‘access’ (i.e. being connected to the network and being able to receive calls) and ‘calls’ (i.e. making a given number of telephone calls). The following table lists their valuation of access and calls as well as their aggregate value for an access & calls package. Customers of type A may be regarded as those who value being connected to the network and being able to receive calls without necessarily making very many calls themselves. By contrast, customers of type C mainly value making calls.

Table 3: Bundling of services – a stylised example

	A	B	C
Access	7	6	1
Calls	1	5	7
Access & calls	8	11	8

If an incumbent operator were allowed to offer Access & Call packages to its customers, it would choose to offer the full package at a price of 8, thus serving all customer types. If instead it were required to offer access and calls separately, it would maximise its profits by offering access at a price of 6 to customers of type A and B, and then pricing calls at 5 to customers of type B only. Customers of type C would not be served at all. Even competition in the provision of calls would not change this – assume, for example, that such competition would reduce the price of calls to 1, so that both customers of type A and B would obtain call services. The incumbent would still not have any incentive to connect customers of type C, as this would require a significant reduction in the price of access to customers of type A and B. However, the incumbent could offer a calls & access package at a price of 5, in response to which all customer types would decide to buy. This would obviously render the entrant’s call services unattractive, but undercutting the entrant in this manner is the only way in which an incumbent subject to non-discrimination and CS/CPS obligations can attract all customer types.

3.2.3 Other regulatory constraints

Finally, implementation problems also arise from the interaction of regulatory measures. For example, a requirement for uniform pricing in the presence of significant cost differences creates the potential for inefficient arbitrage. This has been recognised as a problem with respect to universal service obligations

that require geographically uniform pricing of services in the presence of potentially significant cost differences. Although approaches to neutralise the effects of these distortions are easy to devise in theory, implementing them in practice may be difficult.²⁹

3.3 Implementation costs

Regulation is not without its own cost. Providing information to the regulator is costly for firms. Verification and assessment of this information is costly for the regulator. Similarly, ensuring compliance with regulatory obligations and monitoring firm behaviour uses up resources. In addition to these direct implementation costs, there are further costs associated with regulatory policy, namely costs incurred in trying to affect the outcome of regulatory decisions (lobbying costs) and costs associated with additional uncertainty that the regulatory process might create. Finally, there are welfare costs associated with 'getting it wrong', which need to be set against the benefits of regulatory intervention where the unregulated outcome is suboptimal.

These various costs vary with the regulatory approach taken, but unfortunately there is again a complicated trade-off: a more rule-based approach perhaps reduces uncertainty and lobbying incentives, but may require the provision of considerable amounts of information and may produce undesirable outcomes with an unacceptably high probability. Moving towards a case-by-case analysis may increase the likelihood of intervening only where appropriate, but will increase uncertainty and the scope for disputes, and may also affect the cost of providing and evaluating information. There is no magic solution to this problem, but regulators need to be aware that the idea of a flexible, yet certain and easy-to-implement regulatory regime is a pipe dream pursuing which is no substitute for assessing the trade-offs that have to be faced in practice.

3.4 Interaction between regulatory measures

In assessing the impact and effectiveness of regulatory measures, it is important to take account of the fact that (a) the regulated firm may seek to adopt strategies that undermine the effectiveness of the remedies adopted and (b) potential beneficiaries (e.g. new entrants relying on regulated supply of network or wholesale services) will 'arbitrage' across the various options that regulation makes available to them.

An example for the first effect is the incentive of regulated firms facing regulatory constraints in one market to leverage market power into another market, using strategies that are not immediately covered by regulation, or behaviour which may not easily be monitored. For example, tight regulation of interconnection charges (e.g. origination and termination charges) may result in attempts to increase the cost of interconnection faced by new

²⁹ See Armstrong (2002a) and (2002b).

entrants through delaying interconnection or degrading the quality of interconnection links.

An example for the second effect might be the availability of a number of options for new entrants to gain access to subscribers connected to the incumbent's network. Wholesale line rental, bitstream access, full metallic unbundling or line share options may all be considered as alternative, albeit not necessarily perfectly substitutable, options of providing services to customers. The availability of wholesale line rental may affect the attractiveness of, say, taking unbundled local loops (e.g. if the business case for using unbundled loops rests on the provision of both POTS and broadband services, and the availability of a wholesale line rental product puts pressure on POTS pricing, thus affecting this revenue stream available to the user of unbundled loops). Perhaps more obviously, the availability of wholesale equivalents of retail products can reduce incentives for using network services in combination with investment in own infrastructure. Underpricing *either* wholesale services *or* network services will in this case discourage investment.

3.5 Summary

Given the potentially significant impact on investment incentives, the inherent problem resulting from the option value associated with obtaining regulated access to the incumbent's network infrastructure and implementation problems arising from lack of information, cost-based access regulation needs to be assessed very carefully. In particular, there is a risk that, by setting access prices too low, regulation may help to sustain the incumbent's infrastructure monopoly (even in cases where competition is feasible and desirable). This risk grows disproportionately with the number of detailed access prices a regulator decides to set, in particular where the network and wholesale services in question are substitutes (even if imperfect) from the access seeker's perspective. This is because under-pricing any one service will undermine investment incentives even if, on average, access prices were set at the right level.³⁰

It is in some ways ironic that the very principles – using LRIC established on the basis of MEA - that have been adopted in order to ensure that regulation does provide the correct incentives for efficient entry and discourages inefficient entry are likely to undermine investment incentives in network infrastructure. Although this built-in bias against new investment might be entirely appropriate if infrastructure investment is benchmarked against a scenario of perfect access regulation, a more cautious approach seems to be required where facilities-based competition is feasible and desirable (taking

³⁰ Note that under-pricing some services and over-pricing others will not cancel each other out, as entrants will have an incentive to seek the lowest-cost option. A good indication of a situation in which some network/wholesale services are under-priced is where entrants are not using some (or even a large proportion) of the services available.

account of both the impact of duplication of infrastructure on unit costs, and the wider benefits of competition in achieving objectives that would be difficult to achieve with necessarily imperfect regulation).

Certainly, the case for regulating access charges close to LRIC established on the basis of bottom-up MEA models is less than clear cut, in particular where infrastructure competition is economically viable. In any case, regulators will have to form a view about how likely and desirable investment in alternative infrastructure is in various markets, and then adopt a cautious approach to setting regulated access charges where network assets are in essence replicable. Alternative measures that do not require the regulator to establish access charges, or at least maximise the options for the regulated firm to determine the structure of prices, need to be considered seriously and might be applied in preference to regulated access charges.

Alternatively, it may be appropriate to have access charges increasing over time, or access being available at regulated terms only for a limited period of time. This should address the fact that access can be both a facilitator of entry and a substitute for investment. Whether and how the NRF allows NRAs to impose a time-limited requirement to provide access, or to increase such a time-limited access service or a service with increasing charges - may not be easy to implement under the regulatory framework.

Ultimately, the regulator will have to make a choice with regard to the emphasis it places – in many cases implicitly – on supporting the development of infrastructure-based competition and service competition over common infrastructure. With regard to narrowband services, this choice appears to be rather straightforward, suggesting that the local loop is an area where full-blown competition will ultimately be unachievable other than through infrastructures such as cable network that are able to exploit economies of scope across a range of services including POTS.

To the extent that the business models for the deployment of those infrastructures at least partly rely on POTS or POTS-type revenues, treating the local loop as if it could not be replicated, and thus bringing down access charges to the level at which they just cover the incumbent's investment cost, might have an impact (even if only a marginal one) on such alternative infrastructure investment.

Where the replication of network infrastructure, and thus facilities-based competition, is unlikely or undesirable, provision of network access at costs that maintain the investment incentives for incumbent operators is appropriate. This would correspond to marginal cost pricing of access in the absence of fixed and common costs, which are however endemic in the telecommunications sector. The solution for the problem of devising appropriate mark-ups is clear-cut in theory, but difficult to implement in practice: regulators often consider the informational requirements for Ramsey pricing to be too high to make this a practical option. However, as

Laffont and Tirole (2000) point out, the use of price caps relies on the regulated firm's ability to find the optimal structure of prices, taking into account demand considerations. Thus, in their words, it is *"surprising that regulators who routinely design price caps dismiss offhand Ramsey pricing as being informationally infeasible!"*³¹

For these reasons, regulating the specific terms and conditions on which access has to be provided might be regarded as a measure of last resort. Unfortunately, in many cases access obligations without regulated terms and conditions are unlikely to bite. Leaving the setting of access charges to private negotiations subject to a regulatory backstop might appear attractive, but only disguises the fact that the principles that the regulator would apply when making a determination (or past determinations made) can have pretty much the same effect on the outcome as an explicit regulatory setting.

Alternative approaches that focus on the process by which disputes are resolved rather than the specific criteria on the basis of which an outcome would be determined might be worth considering in order to provide the strongest incentives to parties to come to an agreement. For example, pendulum arbitration (where, rather than trying to find a compromise between the positions presented by the parties, the arbitrator has to adopt the proposal of one party to the dispute) is often regarded as a mechanism that provides incentives for the parties to adopt 'reasonable' positions. However, even with pendulum arbitration the principles on which the arbitrator would choose which proposal to accept are important, as the incentives to present a reasonable case depend entirely on the increase in the probability of having one's position adopted by the arbitrator as a result of not exaggerating one's case, so that it would be considered by the arbitrator to be closest to the principles that any outcome should follow. For example, if the arbitrator were to pick whichever proposal it sees to be closer to the underlying cost of providing a service, this might, reduce the incentives on the incumbent's side to exaggerate costs, but does not imply that principles other than cost-orientation could be followed by the parties.

With these considerations in mind, let us look in more detail at the specific problems that might arise with regard to network services and retail services in narrowband markets.

³¹ Laffont and Tirole (2002), page 132.

4 Narrowband remedies: an assessment

This section provides a discussion of potential remedies in the context of the different narrowband services identified above, which are clearly related to the markets identified in the Commission Recommendation.³²

Remedies applied to wholesale markets (i.e. markets for network services) may consist of one or more of the obligations listed in the Access Directive, or additional obligations subject to approval by the Commission. The Universal Services Directive provides a corresponding list of obligations that may be applied in retail markets.

Obligations listed in the Access Directive are:

- Transparency, i.e. an obligation to make public specified information (accounting information, technical specification, network characteristics, prices etc.).
- Non-discrimination, i.e. an obligation to apply equivalent conditions in equivalent circumstances, and not to discriminate in favour of the regulated firm's own subsidiaries or partners.
- Accounting separation, i.e. an obligation to make transparent the internal transfer prices to the regulated firm's own downstream operation in order to ensure compliance with a non-discrimination obligation or to prevent unfair cross-subsidies.
- Access obligations, i.e. obligations to meet reasonable requests for access or interconnection or use specific network elements. These may include a range of obligations, including an obligation to negotiate in good faith over terms and conditions of providing access.
- Price control and cost accounting obligations, i.e. a requirement to set cost-oriented access charges or the imposition of a price control on the regulated firm. This is restricted to cases where the market analysis suggests that otherwise access charges might be sustained at an excessively high level, or where the firm might engage in a margin squeeze.

Obligations mentioned in the Universal Service Directive include the prohibition of excessive or predatory pricing, undue price discrimination or unreasonable bundling of services, which may be implemented through price caps or individual price controls.

³² Note that the nature of the problem, and the suitability of various remedies, would not appear to vary across markets defined by customer type (e.g. residential or non-residential customers). Of course, competitive conditions may vary across different customer groups, but this would presumably be captured in the assessment of whether a market does require ex-ante regulation, and the determination of SMP operators.

In the remainder of this section, we will discuss the relative merits of these obligations with regard to addressing the problems one may expect to find in the various narrowband markets.

4.1 Wholesale markets

4.1.1 Call origination

With regard to call origination services, two distinct concerns can be identified:

- Market power in the provision of network access may be exploited through inflated prices;
- Vertically integrated firms may leverage their market power into calls markets, as described above.

In order to identify the underlying problem most clearly, it may be helpful to start from a situation in which access providers³³ compete with each other for signing up customers, and then sell access to these customers to call providers (who require origination and termination services). The revenues earned by such a firm would come from charges to the subscriber (i.e. connection charges and line rental charges) and wholesale access charges to downstream providers of call services. In order to attract subscribers, competitors could lower subscriber charges, but in a competitive environment with no excess profits this would have to be accompanied by higher origination charges³⁴ and thus increase the price of services the subscriber would ultimately face. In a competitive environment, firms would structure their prices in such a way as to maximise the benefits enjoyed by their customers subject to just recovering their costs.

In the absence of effective competition, access providers would have an incentive to raise overall prices (subscriber charges, wholesale charges, or a combination of both). Whether they would exploit their market power at the wholesale level, or continue to price call origination at the competitive level and extract profits through higher subscriber charges depends on the relative impact on demand. There are good reasons, however, to assume that the

³³ Note that the general argument holds regardless of whether these access providers also operate core network infrastructure. The main difference arises with regard to the scope of price caps.

³⁴ This assumes that termination charges are set at a level that extracts the maximum profit from those calling a subscriber, and thus not subject to the same competitive constraints even if competition for subscribers is intense. This is the assumption underlying the definition of a market for termination on each operator's network (and might thus be set at the same level regardless of whether or not there is competition for subscribers). However, this assumption may not be justified for a number of reasons, including the existence of closed user groups, benefits obtained by subscribers from receiving call, and the adjustment of calling patterns in response to the relative costs of making and receiving calls (see Maldoom, 2002).

access provider would have an incentive to maximise the benefits a customer can obtain from subscribing, and extract profits through higher subscriber charges. In any case, an appropriate regulatory response might be to use a well-designed price cap³⁵ covering subscriber charges and network charges (in combination with some additional constraints on termination charges) in order to eliminate excessive profits, but leave full flexibility with regard to the structure of charges to the regulated firm.

Alternatively, if subscriber charges were constrained to a particular level (e.g. because of universal service considerations), the firm would need to increase its wholesale charges in order to extract profits. Again, however, the only concern would be about the level of origination and termination charges, not their structure. In particular, a vertically separated access provider would structure its mark-ups in a way that minimises the negative impact on demand.³⁶ Also, the firm would have incentives to offer differentiated products (e.g. different pricing plans for call origination³⁷) as required by customers. For example, there would be no reason to refuse supplying a flat rate call origination product if downstream operators required this in order to provide a flat-rated internet access service to their customers. The incentive not to supply such a service arise entirely because such a refusal would give an advantage to the firm's own downstream operation, which is not a consideration in a vertically separated environment. As access seekers are only customers, and not competitors, there would be no incentive to discriminate or refuse to supply particular services.

Using a price cap to control the overall level of network charges (in combination with some additional constraints on termination charges) would appear to be an appropriate regulatory response.

Added complications arise if the access provider is also active at the downstream level, i.e. is vertically integrated. In this case, access seekers turn from customers into competitors, and the access provider might have an incentive to discriminate against independent downstream firms and in favour of its own downstream operators. Laffont and Tirole (2002) list a number of exclusionary strategies, namely:

- refusing or delaying interconnection (e.g. by claiming high costs of supplementary capacity to satisfy access demand of competitors, or delaying upgrade of switches until the regulated firm can provide similar services);

³⁵ For a discussion of the relative merits of price-cap regulation (and other forms of incentive regulation such as, for example, banded rate of return regulation or various sharing schemes see Sappington (2002).

³⁶ For example, a multi-product monopolist would devise a price structure in line with Ramsey principles, taking account of the relative price responsiveness of demand for the various products and any demand interrelationship that exists.

³⁷ For example, particular combinations of per-minute charges and fixed charges.

- raising rivals' costs (e.g. through refusals to unbundled network elements and thus forcing rivals to purchase services which they would not require, requiring rivals to obtain costly equipment, technological choices that favour the operator over its competitors, or requirements for competitors to disclose business plans or other commercially sensitive information); and
- lowering rivals' demand (e.g. through delaying the provision of number portability, imposing long access codes on rivals, or not dealing speedily with network problems affecting rivals' customers so that competitors appear to be providing services of lower quality).

In the case of vertically integrated operators, in order to establish the underlying cost of providing network services (which would be required in order to determine the appropriate level of charges) may require some form of accounting separation (allocating, where required, costs that are common across the operation of the access network and the provision of call services to customers to the access business).

Having established the appropriate average level of network charges, incentives to discriminate in favour of the own downstream operation may need to be addressed through non-discrimination requirements. However, this has the disadvantage of losing potentially very beneficial variation in the structure of wholesale charges.³⁸ Moreover, in order to ensure that the regulated firm does not use non-price terms in order to discriminate against competitors (e.g. delay in providing interconnection, unreasonable requirements with regard to equipment used by interconnecting operator or information that the interconnecting operator needs to provide), this might include the definition of well-specified access obligations and the entitlement of access seekers to request access to particular network elements.

Where there are incentives to discriminate in favour of the incumbent own retail operation, it may well be necessary to mandate the provision of certain network products where these are necessary to support competing retail products. One example is flat-rate internet access call origination (FRIACO). Using only standard call origination products, third parties may not be able to provide flat-rate dial-up access to the internet in competition with the incumbent operator, who can take advantage from the fact that LRIC-based metered call origination charges are significantly above the marginal cost per minute of origination. Whilst a vertically separated network operator would have an incentive to make a call origination product that combines high fixed charges and low (or zero) per-minute charges to all access seekers, a vertically integrated operator might not, requiring the regulator to mandate the provision of a FRIACO product.

³⁸ Laffont and Tirole (2000) stress the importance of discriminatory wholesale charges in order to (a) ensure efficient recovery of fixed and common costs and (b) support tariff differentiation at the retail level (optional calling plans).

An alternative approach would be to remove the incentive for discrimination. This incentive is based on the expectation that, by restricting competition in the downstream market, it is possible to extract profits there rather than in the upstream market where market power is regulated. Removing the scope for extracting profits from the downstream market will also remove the incentive to restrict or distort downstream competition by discriminating against downstream competitors

For example, if the vertically integrated firm's downstream operation were subject to regulatory constraints that extracted supernormal profits, this would remove the incentives for anti-competitive discrimination, and thus allow the continued use of an overall price cap within which the regulated firm is free to structure charges in response to demand.

One solution for removing incentives to discriminate against downstream competitors discussed in the literature is a so-called global price cap, covering wholesale and retail charges set by the regulated firm. As the analysis by Laffont and Tirole (2000, p 170 f.) shows, a global price cap with exogenously set weights reflecting the forecast quantities would have the property that:

- operators set an optimal price structure, i.e. structure their mark-ups in line with Ramsey principles;
- operators do not have an incentive to price access in a way that discriminates against downstream competitors and thus distorts or restricts downstream competition.³⁹

As the price cap includes retail prices, such a solution might at first sight appear to be more intrusive than pure access price regulation. On the other hand, it provides the regulated operator with more flexibility in terms of deciding the structure of its prices, and would remove the need to prescribe in great detail non-price terms under which access services have to be made available.⁴⁰

Overall, the following conclusions can be drawn with regard to remedies:

- If competition for subscribers is effective, no specific remedies with regard to call origination charges are required. Competition for customers constrains origination charges in the same way as it constrains retail charges. The only incentive to refuse supply to an

³⁹ However, as Laffont and Tirole (2000, p 174 f.) point out, under a global price cap it would be easy for an operator to engage in a margin squeeze. This might be profitable if, as a result, the regulated firm could squeeze out a competitor which could otherwise act as a benchmark for future price cap reviews, and thereby obtain a more generous price cap than would otherwise be the case.

⁴⁰ In terms of the difficulty of implementing a global price cap, there is the need to establish weights based on the forecast quantities of services provided at the wholesale and the retail levels. Any assessment of the additional burden this would create has to take account, however, of the reduced need to engage in detailed regulation of many other terms and conditions of access.

access seeker would arise where the firm would be less efficient than the access provider in the downstream market, and therefore the end-to-end cost of service provision would be higher.

- With insufficient competition for subscribers, charges for call origination may be set at an excessively high level, and some form of price control will be necessary. None of the other obligations listed in the Access Directive, either on its own or in combination with others, appears to be sufficient to constrain market power.
- If the access provider were not also competing in the provision of calls, a network price cap without any further restrictions on the structure of charges would be appropriate. This is because the access provider would not have any incentive to discriminate against particular access seeker, or refuse to offer a structure of tariffs that facilitates the access seeker's operation in the downstream market.
- In general, price caps⁴¹ are preferable to the specification of detailed access charges for a well-defined list of services because they allow flexibility with regard to the recovery of fixed and common costs and the design of interconnection products that support differentiation in the downstream market. In particular, price caps avoid the disproportionate risk of undermining investment incentives that arises from under-pricing any one of a series of somewhat substitutable access services. Although setting a price cap will require information about appropriate costs (both in terms of specifying a starting point and the likely efficiency gains relative to the economy overall that the regulated firm is likely to achieve over the cap's duration), such cost information can be collected at a higher level of aggregation, thereby avoiding to some extent the arbitrariness that is inherent in the allocation of common costs to individual access services, and the choice of increment.
- The terms and conditions on which access is granted should vary in line with different levels of commitment of the access seeker (and, consequently, a different level of risk for the access provider) in order not to undermine investment incentives. One would generally expect better terms and conditions for long-term access agreements, reflecting the lower risk of stranded assets for the access provider, and the fact that the access seeker has given up the option to replace buying regulated access with its own investment should this turn out at some point to be cheaper.

⁴¹ Of course, pricing flexibility may also be possible under, for example, rate-of-return regulation. However, price caps have some advantages in terms of the incentives they provide for improving efficiency and reducing costs. In practice, the distinction between price cap and rate of return regulation may become blurred to the extent that, for example, price caps are re-assessed very frequently. For a detailed survey of different forms of price regulation see Sappington (2002).

- Vertical separation of network and retail business may be appropriate, provided there are no strong scale economies across network and retail activities (which would make vertical separation costly). Although the NRF does not appear to empower regulators to require vertical separation, regulatory policy may be able to provide incentives by making clear to firms that they would face a different set of regulatory obligations if they were to organise their network and retail businesses so that interaction is through arms-length transactions.
- With vertical integration, regulation will also need to address the incentives for restricting or distorting competition in the downstream market by discriminating in favour of the regulated firm's own downstream operation. Regulatory obligations to stop discrimination can take the following form:
 - Imposition of non-discrimination requirements in combination with transparency and accounting separation in order to facilitate monitoring and enforcement of the non-discrimination requirement.
 - Imposition of accounting separation in combination with regulatory measures in the downstream market to remove the incentives for discrimination.

The second solution should allow welfare-enhancing discrimination to take place, and might therefore be preferable.

- In order to prevent the use of non-price terms for discrimination, it may be necessary to impose a range of access obligations on the regulated firm, establishing the network elements which should be available to an access seeker. It may also be necessary to specify the call origination services that have to be made available (e.g. FRIACO). One should note, however, that enforcing non-discrimination through non-price terms can be very difficult, and may often require rules that also capture behaviour that is genuinely efficient.
- Particular care has to be taken in order to ensure that the regulated firm does not force access seekers to provide information that would put the integrated firm at an unfair advantage. Where this is necessary in order to meet access obligation (e.g. an advance notification of changes in demand, or of wishing to interconnect at different points), the integrated firm's downstream operation must not be allowed access to this information and appropriate monitoring systems must be in place. Appropriate penalties must be available to sanction any breach of such obligations.

4.1.2 Call termination

Without competition for access customers, call termination services are not different in principle from call origination services and may therefore be treated in the same way by regulators. Thus, where infrastructure competition in the provision of access is lacking, no additional considerations are required.

However, as noted above, additional problems arise with regard to termination charges from the fact that an increase in termination charges does not increase prices of calls made by the access provider's customers, but rather by subscribers connected to competing networks. This implies that termination charges will become an issue in particular where competition for access customers is intense, and where the setting of termination charges can also be used to affect such competition.⁴² The remainder of the discussion of termination charges focuses on a situation where there is competition between access providers, each of which may face regulation of its termination charges.

In addition to the problem of a double mark-up that may arise in the non-cooperative setting of termination charges⁴³, the academic literature has identified a number of conditions under which termination charges may be used in order to support higher retail prices.⁴⁴

To the extent that termination charges are set in support of termination-based price discrimination (e.g. requiring higher prices for cross-net calls than for on-net calls), they generate tariff-mediated network externalities and can be used to discriminate against smaller networks, typically new entrants. However, the welfare implications of termination-based price discrimination are ambiguous, as it may lead to more intense competition, and may reduce the double-marginalisation problem in cases where networks are not close substitutes.⁴⁵ As the negative effects are most pronounced when network sizes differ, termination-based price discrimination should not *prima facie* be regarded as an issue where networks are of similar size, but should be subject to closer scrutiny where network sizes are very different.

It is worth noting that the problem of charging potentially excessive termination charges does not disappear as competition between access providers becomes more effective. However, intense competition for subscribers can constrain termination charges under two conditions:

- subscribers care sufficiently strongly about receiving calls, and

⁴² One implication is that this difference between origination and termination only disappears in the case of a perfect monopoly in the provision of network access. In this case, the access provider should be indifferent about the precise split of origination and termination charges, which are sold in fixed proportions to downstream firms.

⁴³ This problem arises where imperfect competition between firms leads to call charges including a mark-up over termination charges, which themselves include a mark-up over the appropriate level of costs (i.e. including an element of economic profits).

⁴⁴ See, for example, Armstrong (1998), or Laffont, Rey and Tirole (1998a). However, Laffont, Rey and Tirole (1998b) and Laffont and Tirole (2000) also provide a number of reasons why termination charges might not be expected to facilitate collusion at the retail level (though the resulting price structure may still be distorted).

⁴⁵ See Laffont and Tirole (2000).

- expected incoming call volumes are linked to the termination charge of the network to which a customer subscribes.⁴⁶

If either of these conditions does not hold, competition for subscribers does not necessarily eliminate concerns about potentially excessive termination charges.

As well as creating additional problems, the mutual dependency of competing networks on each other's termination service provides the opportunity for additional regulatory measures, such as the requirement that bilaterally agreed termination charges be reciprocal. This means that an operator cannot increase its rival's costs without also increasing its own. Whether this imposes a sufficient constraint on commercially negotiated termination charges, however, depends on a number of factors including the extent to which traffic between two networks is imbalanced, and the impact that retail price cuts by one network would have on these traffic flows.

It may also be possible to require termination charges to change in line with other network or retail charges, which are subject to competitive pressure. For example, by linking changes in termination charges to changes in retail prices it may be possible to bring competitive pressures to bear on termination. Of course, establishing such a link would not address any initial distortion (i.e. the starting level of termination charges being too high relative to other prices), and it may still be necessary to establish an appropriate starting level for termination charges.

In the case of asymmetric networks and heterogeneous calling patterns, differences in termination charges can be used in order to affect the incentives and ability of entrants to compete for particular types of customers, and allowing differences in termination charges may be used in order to support entry.⁴⁷ For example, termination revenues can provide a strong incentive to compete for customers (as well as a source of revenues to fund customer acquisition). Although this entails a transfer between customers – those calling the customers connected to the new entrant's network partly subsidise their acquisition – such a transfer may be justified where they might benefit from network externalities (as has been argued in the case of mobile termination charges) or increased competitive pressure and thus lower prices.⁴⁸

Overall, the following conclusions can be drawn with regard to remedies:

⁴⁶ The latter may not hold for a number of reasons, one of which is number portability mandated under the Universal Services Directive.

⁴⁷ See Armstrong (2002b).

⁴⁸ A similar argument has been made in the context of spreading the cost of number portability across all customers, collecting contributions also from customers who would not consider changing operator and porting their number. Having such customers contribute to the cost of providing portability has been justified with reference to the benefits they would obtain as a result of improved competition leading to lower prices and better service.

- Without competition for subscribers, termination services are similar to origination services, and should be treated in a similar way for regulatory purposes.
- It may be necessary to regulate call termination even if competition for subscribers is vigorous in order to correct for distorted price structures. In order to see whether there is a risk of distorted pricing, one would need to establish empirically the extent to which termination charges are constrained by subscriber's concerns about the cost of incoming calls, and the extent to which inbound call volumes respond to termination charges. However, in the case of fixed networks offering mainly calls to geographic numbers, the caller would not generally be able to identify the called network, and therefore there is a strong presumption that incoming call volumes are not linked to an individual network's termination charge.⁴⁹
- Inclusion of termination charges in an overall network price cap without any further restrictions may be an insufficient constraint, as the underlying problem persists even if network operators were not to earn any supernormal profits. It is one of charging too much for termination and too little for other services, rather than one of simply charging too much for termination.
- It may be possible to tie changes in termination charges to changes in other charges that are subject to immediate competitive pressure. Using the same operator's charges as a yardstick may have the undesirable consequence of reducing the incentive to compete on these charges. Using an average of competing operators' charges, by contrast, has the benefit of further sharpening the incentives to compete because any reduction in prices will also reduce the

⁴⁹ Where competition for subscribers is effective, the welfare losses from excessive termination charges are the result of a distorted pricing structure (termination charges being too high and other charges being too low) structure rather than due to overall excessive pricing (i.e. all charges being too high). The potential benefits of regulatory intervention in this case do not arise from making customers better off at the expense of operators (transferring excessive profits into consumer surplus), but from correcting a distorted pricing structure. Even if there are overall benefits to be gained, some consumers will be made worse off. Moreover, while the presence of excessive profits is a clear-cut indicator of allocative inefficiency, and removing excessive profits is likely to improve welfare, correcting a distorted pricing structure is much more difficult as the correct pricing structure is likely to be subject to considerable uncertainty. Put differently, whilst (under certain assumptions) reducing charges to the point where excessive profits disappear is unambiguously welfare-improving, reducing some charges whilst increasing others cannot be said unambiguously to increase welfare, even if the same assumptions hold. Thus, even though a cost-orientation requirement for termination charges may be appropriate, concerns arising from the difficulties associated with measuring the costs of a particular network service correctly, and establishing the correct mark-ups in order to recover fixed and common costs, need to be taken seriously, and may ultimately suggest regulatory forbearance.

termination payments that have to be made to other operators. In both cases, however, there would be a need to determine a starting point, assuming that unregulated termination charges are excessively high.

- As the root cause of the problem is the fact that the calling party, and thus not the customer of the network providing termination services, pays for the call, a move to a system whereby the receiving party pays for calls can be considered. However, such an RPP regime would create other, potentially worse, distortions and has been held responsible for the slow take-up of mobile telephony in the United States and (initially) Mexico.
- Leaving the negotiation of termination charges to operators subject to a reciprocity requirement may be sufficient⁵⁰, providing that this does not create the risk of operators using termination charges to sustain higher retail prices (as might be the case, for example, where in the absence of effective two-part tariffs, operators cannot reduce their call prices without causing a net outflow of calls, and where therefore higher termination charges can be used to penalise price cuts).
- However, reciprocity requirements may also be used by incumbents in order to discourage entry where there are likely to be differences in the calling patterns of the entrant's customers. These differences determine the net flow of traffic, and thus payments, between the incumbent's and the entrant's networks. For example, reciprocity requirements may cause incumbents to aim for high termination charges where new entrants attract mainly high-usage customers (as in the case of fixed networks, where a new entrant will often only incur the cost of connecting a customer to its network if the customer generates a sufficient traffic volume), and low termination charges otherwise (as may be the case with mobile networks, where high-usage customers have obtained mobile services early on, and new entrants are more likely to compete for low-volume/low-value users). To the extent that incumbents have greater bargaining power (e.g. as a result of being better able to sustain long and protracted negotiations), they will have the opportunity to affect termination charges in their preferred direction, and additional regulatory control may be required.

⁵⁰ Armstrong (1998) argues that this may not be the case where the retail price of the incumbent network is regulated. In this case, the new entrant needs to offer lower retail prices in order to win market share, which will cause a net outflow of calls. So the entrant would prefer a lower reciprocal access charge than the incumbent. However, this is based on the assumption that the incumbent's retail price is not only limited from above, but "fixed by regulation", so that the incumbent would not respond to entry by reducing prices below the regulated level. Economides, Lopomo and Woroch (1996) discuss reciprocity as one of a number of pricing rules that might be used in order to neutralise network dominance. However, in their model dominance is captured by one network being first to set its prices, and a competing network being second, irrespective of network size.

- A reciprocity requirement may also be used in order to extend cost-based regulation of one operator to all operators that need to be regulated. It may be inappropriate to require smaller operators, who nevertheless might have SMP in the provision of termination services to their subscribers, to provide detailed cost information, as this could be an undue burden. In this case, the regulator may give such smaller operators the option to agree reciprocal termination charges with a larger firm whose charges have been set on the basis of cost information provided to the regulator, instead of establishing their own costs.⁵¹
- However, reciprocity requirements may be difficult to apply in the case where access providers face significantly different costs, for example because they use different technologies (such as POTS and cable telephony).⁵²
- Imputation rules, which tie termination charges to the retail price of calls originating and terminating on the same network, may bring competitive pressure on the price of on-net calls to bear on termination. However, this does not necessarily imply lower overall prices, and the welfare implications of an imputation rule are ambiguous.⁵³

4.1.3 Conveyance and switching

Competition problems in the core network, i.e. with regard to conveyance and switching, arise on thin routes where the volume of traffic is insufficient to sustain a number of competing infrastructures. If the access network is tightly regulated, additional problems might arise from the bundling of core network elements with access network elements, but these should be addressed through appropriate definition of the network elements and interconnection points available to access seekers.

⁵¹ In order to make this a viable option, the regulator may have to adjust the cost information provided by the large operator in order to correct for significant differences in scale. For example, where there are three competing providers of access, it may be appropriate to assess the cost of a hypothetical operator serving one third of the market. Such adjustments have been made by the UK Monopolies and Mergers Commission in its 1998 investigation into the cost of calling mobile phones.

⁵² As always, one has to be careful to consider only cost differences that are caused by exogenous factors rather than arising from commercial decisions taken by regulated firms. Regulation must not allow firms to recover costs that have been inefficiently incurred, or that have been incurred for strategic reasons.

⁵³ Economides, Lopotomo and Woroch (1996) show that, in a duopolistic model where network dominance implies a first-mover advantage in setting prices, an imputation rule decreases the dominant network's profits, but increases the second-mover's profits (indeed by more than the dominant network's profits fall, so that overall profits increase). They point out that this can help to attract more entry, and might thus increase competition in the longer term.

The regulatory problems arising with regard to conveyance and switching are not dissimilar to those arising with regard to call origination, and it may be necessary to regulate access to thin routes in a similar manner. This of course presupposes that such elements of the core network have been properly identified.

Additional obligations that may be imposed are:

- A requirement on the SMP operator to use uniform charges for conveyance and switching services, covering both competitive and uncompetitive segments. This would ensure that competitive pressure from those segments where scale economies are unimportant carry over to thin routes. In many instances, the incumbent may use such a uniform pricing structure anyway, and therefore concerns about exploiting market power on thin routes may not be relevant. Where such a pricing requirement were to be imposed, however, a disadvantage is that differences in the underlying cost will not be reflected in differences in access charges, thus creating the potential for cream-skimming by entrants.
- A requirement not to bundle services provided on thin routes with services provided on competitive segments. However, this may prevent some genuinely efficient bundling strategies, and should therefore be assessed with care.

Where it would not be economically feasible for smaller operators to enter into interconnection agreements with all other access network operators in order to ensure that their customers can call any other network participant, it may be necessary to require the incumbent PTO to offer termination through its network of interconnection agreements together with transit services needed to carry a call to the respective interconnection points. The charges for this service should include a mark-up on the sum of the conveyance charge and the termination charge paid by the incumbent to the respective network so that the operator using the incumbent or PTO does not have the option to free-ride on the incumbent having to have interconnection agreements with all other operators.

4.2 Retail markets

4.2.1 Access

Where competition in the provision of access is lacking, one would expect the corresponding subscriber charges (connection charges and line rental) to be excessive. However, for historical reasons the situation in most Member States is exactly the reverse: subscriber charges for access are often below cost (resulting in a so-called access deficit incurred by the incumbent operator). Universal service obligations are likely to continue to limit the extent to which subscriber charges for access can be increased. Put differently, regulatory constraints on retail access prices may often exist irrespective of any market power issue.

It is well known that such universal service obligations, in particular where they require geographically uniform pricing in the face of significant cost differences, can significantly distort competition, allowing inefficient entry where charges are above cost, and preventing efficient entry where charges are lower. Even though geographically uniform pricing ensures that competitive pressure extends from those areas where competing access infrastructure exists to those where it does not, it undermines the incumbent's incentives to compete in the former.

A number of alternatives has been discussed with regard to how universal service should be provided efficiently (which is distinct from, albeit related to the question of how universal service provision should be financed.⁵⁴ For the purpose of the following discussion, we assume that subscriber charges for access do not exceed costs, and may be below cost (at least for some subscribers).

As noted above, this would create incentives to increase network charges in order to:

- exploit market power by charging high prices to those who require access to the subscriber as an input in the provision of calls services; and
- sustain higher call prices for the incumbent.

Where network charges are effectively regulated, incentives for discrimination against competing providers of call services emerge. A number of exclusionary strategies exist at the network level, focusing on non-price terms of interconnection. The main concern with regard to retail access services is that the incumbent might engage in strategies that support or reinforce discrimination against independent call providers, such as bundling of access and call services in a way that might make it more difficult for CPS/CS operators to compete in the provision of calls, or using the subscriber relationship in order to engage in unfair or anti-competitive marketing practices aimed at CS/CPS operators.

With regard to the bundling of access and call services (e.g. by including free or discounted call minutes with the line rental charge) the challenge for regulatory policy is to make sure that such bundling strategies do not prevent effective competition in the provision of calls whilst at the same time not restricting the incumbent's ability to develop attractive calling plans which might increase overall output and better match the requirements of different customer groups:

- The incumbent should be required to offer at least one access service without any bundled calls, which would then allow customers to obtain call services from other firms. Regulation needs to ensure that the

⁵⁴ See, for example, Laffont and Tirole (2000). Armstrong (2002a, 2002b) discusses the implications of difference between prices and costs for the setting of network access charges.

price of this stand-alone line rental is set at a level that is not prohibitive. However, it is very difficult in practice to establish whether a particular line rental charge would allow CPS/CS operators to compete effectively in the provision of calls with an incumbent who has considerably more flexibility in devising tariff packages that trade off higher fixed payments with lower usage-related payments.

- An alternative solution would be to require incumbents to offer a 'wholesale line rental product'. This product would then allow other operators (a) completely to take over the customer relationships and (b) devise their own tariff packages. In the presence of an access deficit, such a product would have to be priced with reference to cost. Alternatively, the incumbent could be allowed to set its price subject to being able to demonstrate that, given this price and facing the same charges for network services as third party operators, and given the range of tariff packages it offers, it can operate profitably. The potential disadvantage of such a product is that it might impact on the relative attractiveness of local loop unbundling, and thus slow down the take-up of unbundled loops. It might also undermine incentives for the roll-out of competing access infrastructure – although given the cost structure in the local loop this risk is perhaps rather limited.

Requiring the incumbent to provide a wholesale line rental product would also address problems arising from the incumbent's continued customer relationship, which might be abused, for example, through targeted marketing against CPS/CS operators. Potential abuse of this customer relationship might otherwise need to be addressed through stringent rules on permissible marketing activities and a code of conduct that has to be followed by the incumbent.

4.2.2 Calls

Assuming that network access is regulated effectively, little or no regulation of retail call services appears to be necessary as competition between operators (being able to obtain network services from the regulated incumbent) should ensure that prices are at the competitive level. However, as has been pointed out by Laffont and Tirole (2002), absence of retail level regulation can be responsible for incentivising the vertically integrated incumbent to engage in discriminatory strategies: they advocate the use of a global price cap, covering both network and retail services in order to remove as much as possible incentives for discriminatory practices and maintain maximum pricing flexibility to the regulated firm so as to allow the firm to respond to demand conditions. This may need to be complemented with sub-caps or additional constraints on individual prices (such as price floors) in order to address concerns about the potential for reducing prices where competition is intense (perhaps below marginal costs, thus creating problems for new entrants),

which gives the regulated firm more scope to increase prices for services where effective competition is lacking.⁵⁵

CPS and CS obligations should ensure that the incumbent does not enjoy any particular advantage in the provision of call services as a result of also providing access. However, there are concerns that some customers have a preference for receiving a single bill, which would imply that CPS and CS operators are at a disadvantage relative to incumbents. Whether this effect is sufficiently strong to impact on the effectiveness of competition is an empirical question. For example, even if a subset of customers has a strong preference for single billing, this may not be relevant for the effectiveness of competition provided that (a) there is a sufficiently large number of customers without such a preference, and (b) the incumbent cannot segment the market into those customers who do and those who do not have a preference for single billing. The extent to which customers use multiple CS or CPS operators (e.g. for national and international calls), or make use of both CPS and CS could provide some indication for the extent to which there is resistance to multiple bills.

However, should a preference for a single bill exist to an extent that competition between incumbents and CPS/CS operators could be distorted, a number of obligations may be imposed on the incumbent:

- The incumbent may be required to bill its access customers on behalf of the CS/CPS operator. Whilst this removes the disadvantage of multiple bills, it may be undesirable because it reinforces any incumbency advantages that are based on direct customer relationships. In this case, the CPS/CS operator may find it more difficult to market new services to its existing customers than in the case where it has a direct customer relationship through the billing arrangement. Moreover, the incumbent obtains information on usage patterns which might help it to target product offerings at particular customers designed to replace the CPS/CS operator.
- Alternatively, the incumbent may be required to allow the CPS operator to bill the customer for line rental on its behalf (retail line re-billing). This solution is similar to the provision of a wholesale line rental product, except that the line rental element of the bill would still be determined by the incumbent rather than the CPS operator.

Potentially anti-competitive behaviour such as, for example, attempts to engage in predatory pricing (often referred to as a margin squeeze, given regulated network charges), anti-competitive price discrimination or bundling should more appropriately be dealt with under competition law. This is because these practices are not necessarily anti-competitive, but may be justified by efficiency considerations, and it is therefore difficult to devise clear-cut rules that could be applied ex-ante but still capture only the anti-

⁵⁵ See Armstrong and Vickers (1993) for a more detailed discussion of this problem.

competitive, but not the efficient variety of such behaviour.⁵⁶ A competition investigation, taking account of the specifics of a particular case, can assess much better whether the practice under consideration has the object or effect of restricting competition, and what the appropriate response should be.

One possible exception to this is predation, for which Baumol (1979) has identified a behavioural constraint that selectively increases the cost of price-cuts that are made in the expectation of being able to drive competitors out of the market and then raise prices again: under this rule, an incumbent would be prevented from increasing its prices for a certain period of time if as a result of the price cut competitors have been driven from the market. However, as Haucap and Kruse (2002) point out, such a rule would need to be complemented by an efficiency defence to allow the incumbent to engage in temporary price cuts which may be desirable for a number of reasons, (e.g. in the case of introductory pricing of new services).

One potential problem with regard to call services arises from the lack of liberalisation in other countries with the effect that only the incumbent operator may be able to provide international calling services on some routes.⁵⁷ This may not only result in excessive pricing of calls on those routes, but might conceivably put CPS operators who cannot offer a full set of international calling services at a disadvantage. Of course, whether this is a problem in practice is an empirical matter. If the proportion of customers who use international calls on routes that can only be served by the incumbent is small, then there are good reasons to presume that the disadvantage for CPS operators is limited (even though there may still be concerns about the exploitation of market power on these routes).

If lack of liberalisation in other countries is found to be a problem on some routes, the following regulatory options may be considered:

- The incumbent could be required to offer such calls on a wholesale basis to other operators, thus eliminating the disadvantage of CPS operators from not being able to offer the full range of international calling services. This is the solution proposed by Oftel in the United Kingdom. However, if wholesale prices are set at retail-minus, this will do little to constrain market power on these routes.
- Alternatively, where the incumbent is the only operator who can send calls to a particular country (and routing through incumbents in other countries is not a viable alternative), international termination may be treated as a network service, and the incumbent may be required to terminate calls at cost, which is given by the termination payment that

⁵⁶ For example, Haucap and Kruse (2002) list a number of reasons for which pricing below costs may be efficient and socially desirable.

⁵⁷ Note that this also requires that routing of calls through other operators who may have a correspondent agreement with the PTO in the destination country is not possible or cost effective, which is a matter that has to be established empirically.

has to be made to the foreign operator plus any network charges for conveyance from the point of interconnection to the point at which the call is handed over to the foreign operator. This would both remove any disadvantage faced by CPS operators, and put competitive pressure on the price of calls on such routes (other than the termination payment).

4.3 Network services, retail services and wholesale services

A general issue related to the interplay between retail and network services in the presence of vertically integrated operators and the resultant incentives for discrimination is the extent to which the incumbent should be required to offer wholesale equivalents of its retail services. At first sight, the requirement to offer every retail service on a wholesale basis (at regulated terms) appears to be incompatible with the objective of promoting the development of competition. Competition from pure re-sellers is unlikely to be self-sustaining and needs to be propped up forever by regulatory intervention. As regulation is necessarily imperfect, so is the outcome of such competition.

The downside of making available wholesale equivalents of retail services is that their availability might undermine or weaken the incentives for investment in competing infrastructure: re-selling might be more attractive than combining network services with own investment in order to provide retail services. As noted above, the Commission Recommendation does not include pure wholesale markets, and there appear to be good reasons for this.

Pure resale competition, relying on regulated access to wholesale equivalents, does not contribute to the development of self-sustaining competition, and will require continued regulation of access charges. More importantly, such competition may undermine incentives for infrastructure deployment. Given the problems discussed above in setting the 'right' access charges (or wholesale prices), it is therefore not surprising that access obligations should focus on network services rather than on pure wholesale equivalents of retail services offered by the regulated firm.

Annex: A simple example of option value

The following simple example⁵⁸ demonstrates the effect of uncertainty and sunkness on investment decision.

Suppose that an operator can decide between investing in a network asset that would allow it to supply its retail customers or alternatively buying network services from another operator. For simplicity, assume that the asset has an infinite life.

Assume further future demand is uncertain, which will be resolved in period two. More specifically, assume that from period two onwards demand may go up or down by 100 units from its present level of 400 per period, i.e. it may be 500 per period or 300 per period for the entire future. The network asset would provide sufficient capacity to serve demand in either case. Let the price per unit be equal to one for all periods.

Assume that the investment has a cost of 2,000, and that the cost of capital faced by the operator is 15%. Thus, the annual capital charge for the asset is 300, and the per-unit capital charge in period one (as well as the expected average per-unit capital charge for future periods) is equal to 0.75. Assume that network services are available at a charge of 0.8 per unit, which is in excess of the expected average per-unit capital charge.

The key assumptions are summarised in Table 4.

⁵⁸ This example is taken from DotEcon (2001)

Table 4: Option values – a stylised example: key assumptions

Cost of capital	15%
Period 1 demand	400 units per period
Demand from period 2 onwards	
High demand (probability 40%)	500 units per period
Low demand (probability 60%)	300 units per period
Cost of undertaking the investment	2000
Retail price per unit	1 per unit
Charge for network services	0.8 per unit
Margin on resale	0.2 per unit
Profit on resale	
High demand	100 per period
Low demand	60 per period
Present demand	80 per period
Net present value (NPV) of infinite stream of resale profit	
High demand	766.7
Low demand	460
Expected NPV	582.7
NPV of infinite stream of revenues	
High demand	3,833.3
Low demand	2,300
Expected NPV	2,913.3

This suggests that the operator would prefer to invest in a situation of high demand, but prefer to resell if demand were low. However, based on a comparison of expected NPVs, the decision would be made in favour of investing as the upside from investing in the case of high demand is so large that it outweighs the downside if demand turned out to be low. Moreover, as at the present level of demand the cost of obtaining network services from another operator is well in excess of the per-unit capital charge, one might get the impression that the operator would have an incentive to invest now rather than to wait and see.

However, this simplistic view ignores the option value inherent in a wait-and-see strategy, which becomes obvious once we look explicitly at the *timing* involved in making the investment. Rather than investing in period 1, when demand is unknown, it is possible to wait until period 2 and invest only in the high demand state. The benefit from being able to choose whether to invest once the uncertainty has been resolved outweighs the cost incurred in the

first period as a result of purchasing network services at charges in excess of the per-unit capital charge. The difference in expected NPVs captures the option value of delaying the investment until the uncertainty that is crucial for the optimal investment decision has been resolved.

Of course, the operator would be best off if it could take advantage of the investment benefits in the present period whilst retaining the flexibility to undo the investment if it would be strictly better off reselling. However, this is not possible if the investment is sunk, and therefore the 'undo investment' alternative is unavailable.

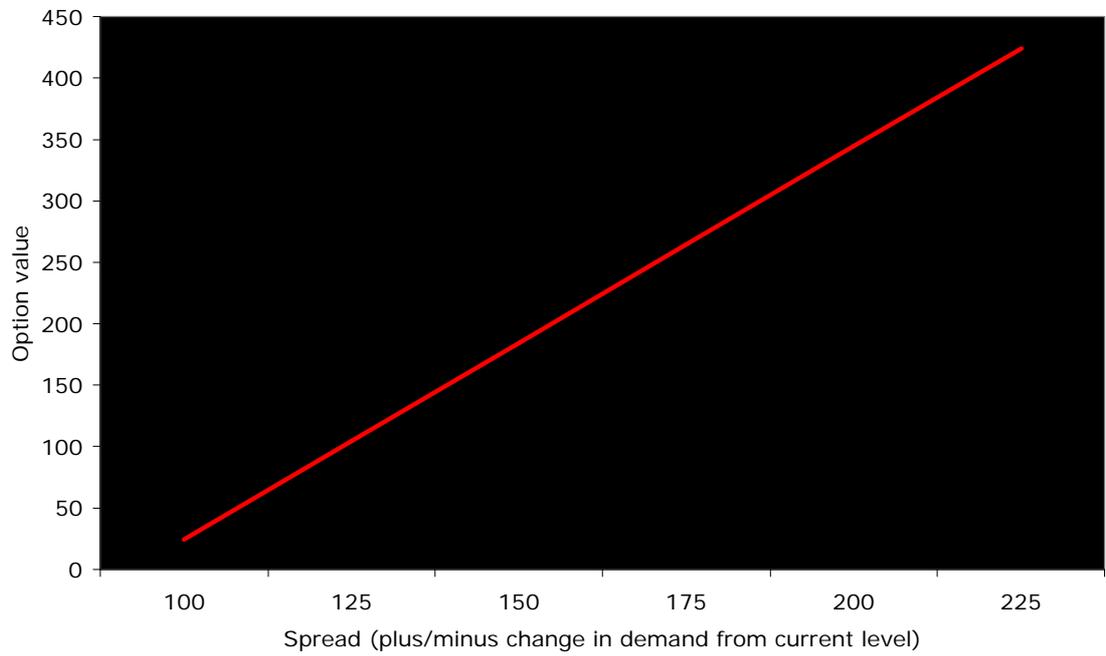
Table 5: Option values – a stylised example: results

Strategy	NPV of Strategy ⁵⁹	Period 1 cash flows	Period 2 expected NPV of cash flows from period 2 onwards
Resale	586.7	80 Resale revenues in period 1 with demand equal to 400	582.7 Expected NPV of infinite stream of resale profits (see Table 4)
Immediate Investment	933.3	-1600 Revenues of 400 minus investment cost	2,913.3 Expected NPV of infinite stream of revenues (see Table 4)
Wait and see	957.7	80 As with resale	1,009.3 Undertake investment if demand is high, continue to resell otherwise (0.4 * 1,888.3 + 0.6 * 460)

As the option value of delaying an investment depends on the extent to which the value of the investment is affected by uncertainty, we would expect the option value to increase with the degree of uncertainty. The above example can be used to demonstrate this effect, and to show that it can be quite dramatic. Leaving everything else equal, but increasing the amount by which demand can exceed or fall short of the present level, we can calculate option value, i.e. the difference between the value of immediate investment and the wait-and-see strategy. The relationship between the option value and the spread (measured by the amount by which demand from period two onwards may exceed or fall short of the present level) is shown in Figure 2. This shows that the option value increase significantly with the increase in the extent of uncertainty.

⁵⁹ Sum of period 1 cash flow and the NPV of revenue streams from period 2 onwards discounted at the cost of capital, e.g. $587.6 = 80 + 582.7/1.15$

Figure 2: Uncertainty and option value



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