

**European sector regulation and investment incentives
for broadband communication networks**

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Abstract

This paper looks at the broadband telecommunications sector to unravel the relationships between sector regulation and investment behaviour in the European Union. Cost based access pricing regimes, although successful in attracting new entrants, have negatively affected the investment in fixed line infrastructure. New entrants show a low propensity to invest in infrastructure and there is an undue emphasis on a single technological platform. These facts may be compared with the mobile telecommunications sector. There access regulation is much less intrusive, because facility based competition induced a much higher degree of competition, while investment levels have decreased much less and the relative shares of investments by incumbents and new entrants are much more aligned with market shares. In order to restore incentives for investment in the view of expanding broadband access, a review of certain access regulation provisions seems to be necessary, possibly by providing greater incentives to facility based entry via platform competition.

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1. Introduction

This paper looks at the broadband telecommunications sector to unravel the relationships between sector regulation and investment behaviour in the European Union (EU). This topic is interlinked with liberalisation. Liberalisation in the infrastructure industry generally refers to the opening up of bottleneck monopoly segments to competition via increased regulatory obligations on the incumbent. This has put the issue of appropriate regulatory measures at the centre stage for successful liberalisation. Since the liberalisation process started in the 1980 there is a rapidly growing literature on the effects economic consequences of sector liberalisation (Newberry, 1999). Empirical studies suggest that economic benefits can be large, but they cannot be taken as granted. Setbacks, such as the case of electricity liberalisation in California are not uncommon. The crux of the matter is that successful liberalisation needs a very careful weighting of the factors that are influenced by industry specific technology features, firm behaviour and regulatory incentives (Armstrong and Sappington, 2006). It is precisely this aspect where more research is needed, as pointed out in a recent survey on the impact of regulation and investment incentives (Guthrie, 2005). This paper wants to provide some evidence specifically to the telecommunications industry in the EU and the incentives for infrastructure investment. This exercise is interesting because there is a common regulatory framework on one hand¹, but considerable national specificities on the other hand.

Regulatory reform in telecommunications, like in other network industries, has been inspired by the concept of open access regulation to bottleneck elements of vertically integrated providers of infrastructure services. Competitive access was seen as the

¹ For a detailed description of the currently adopted EU regulatory framework for 'electronic communications' see Nihoul and Rodford (2004).

means for eliminating the “deadweight loss” from monopoly and to establish efficient service provision. Cost based access pricing regimes were adopted mainly to favour competitive entry. Local loop access products would allow entrants to offer services with minimum upfront investment, while relying on the existing networks of the incumbent. Entrants were then expected to successively invest to an increasing degree in own infrastructure. While successful in attracting entrants, the pricing regime seemed to negatively affect long-term incentives for investment for both the incumbent and new entrants². Certain provisions of access regulation, such as mandatory unbundling at the local loop, seem to have become rather a substitute for investment by new entrants than a complement. As will be shown, new entrants have invested very little. Moreover, the development of alternative technological platforms is penalised by the existence of regulated prices for existing infrastructure. The underlying hypothesis of the current regulatory regime, i.e. appropriate access prices lead to facility based competition, still awaits confirmation. The failure to do so solicits the search for new measures which could be much more conducive to new infrastructure investment.

At the practical level, one has to distinguish between different levels of facility-based competition. At one extreme is a completely independent service infrastructure; at the other is the investment that requires maximum leverage on the infrastructure of the incumbent firm. The implementation is very complex in the case of fixed line telecommunications, because of the large number of access models have been developed, ranging from simple reselling to complete local loop unbundling. This paper shows that none of them has really improved the investment incentives. On the

² This debate was mainly conducted in the US, where access regulation was introduced several years before. See Jorde et al. (2000) and Pindyck (2003)

contrary, as facility-based competition has increased, investment has declined. The crux of the matter lies in the definition of facility based competition. Ideally facility based competition should refer to separate technological platforms. Unbundling of network elements of the incumbent do not achieve this, as unbundling provides competition on the same local access path. This can be contrasted with the mobile telecommunications sector, where access regulation is much less intrusive and competition is on completely different facilities, including customer access. In the mobile sector, investment levels have seen a more favourable evolution and, even more important, the relative shares of investments by incumbents and new entrants are aligned. The paper argues that to restore incentives for investment in the view of expanding broadband access, a review of certain access regulation provisions seems to be necessary. The review should focus on providing greater incentives to facility based entry via platform competition.

The paper is arranged as follows. Section 2 briefly sketches the main regulatory developments in the telecommunications sector in the EU. Section 3 relates the conditions for access to the incumbents network with the investment trends. Section 4 compares these developments with the mobile telecommunications sector. Section 5 draws the conclusions.

2. Regulatory developments

The economic policy debate in Europe is centred around improving productivity growth performance, trying to meet the ambitious quantitative goals set out by the EU leaders in Lisbon in 2000. The telecommunications sector, in particular broadband communications has an important role in this (European Commission, 2003).

Nevertheless, after almost a decade of sector liberalization in the EU³ the economic and financial performance of the telecommunications sector is unsatisfactory. Financial markets currently rank the sector with peers in the low growth category where execution of efficiency programs is paramount (see, for instance, The Economist, 21 September 2006). Hence the financial markets are reluctant to provide funds for long term investment that create the climate for further sector growth. This may be an irony of history because regulatory reform in the sector was inspired by the notion of opening access to bottleneck elements in infrastructure precisely to induce further investment by new entrants. This was supposed to accelerate investment in the sector, which was traditionally determined by incumbent operators. The liberalization programs often entailed also privatisation of the incumbents. Thus access to capital markets became easier for incumbents as they did not any more have to cope with the budget constraints of governments.

The open access regulations put in place were particularly attractive for new entrants as they had a large scope for arbitrage of monopoly rents. The mechanism goes like this. Incumbents have to provide interconnection and access to network elements at regulated prices. But the definition of the relevant costs is a matter of great dispute. One approach considers that access prices should reflect the opportunity cost to the incumbent, including the foregone profit, in order to avoid inefficient entry (and assuming an efficient incumbent). This so called efficient component pricing rule looks at the problem from the point of view of ensuring productive efficiency. Allocative efficiency would instead call for a principle of setting access prices based

³ EU wide sector liberalisation started in 1998, when all telecommunications market were opened up to competition. The 1998 regulatory package was reviewed in 2003, with the new regulatory framework on Electronic Communications.

on direct cost⁴. Such an approach is however very difficult in the case of networks based in a predominant part on sunk costs. It is particularly difficult to find non-controversial ways for calculating access prices, and they are in any case incompatible with allocative efficiency principles. The ways access prices are determined have a strong impact on both the type of entry (service based or facility based) and the investment incentives. In most regulatory schemes, access prices are currently based on some kind of forward-looking long run incremental cost. This implies that the rental price for each network element is equal to the incremental cost of creating and supplying that leased element if the incumbent were designing and constructing a completely new, optimally configured network with state-of-the-art technology. Such a setting for the telecommunications provides clear advantages to new entrants as equipment prices are declining substantially over time and hence forward-looking prices tend to underestimate the effective costs incurred in the past by the incumbent. Moreover, such a pricing rule under-compensates incumbents for the risks in making irreversible investments (Pindyck, 2005). In other words, this asymmetry in network costs gives the new entrant an option to that the incumbent does not have: to enter or exit at will. If this option is properly included into the lease price, the latter underestimates the true economic cost to the incumbent.

If access prices that are too favourable to the new entrant, the incentives of the incumbent to invest in new infrastructure are reduced. This may be accepted temporarily if the new entrants eventually invest on their own. The “ladder of investment” theory (Cave and Vogelsang, 2003; Cave, 2006) postulates that initially new entrants use the facilities of the incumbent for service based competition and

⁴ Allocative efficiency is achieved when all resources are optimally employed so that the maximum benefit to society is obtained. Price is set equal to marginal cost.

later invest in own infrastructure. This approach was notionally adopted in the Netherlands (Rood and te Velde, 2003). However this concept of dynamic access prices with a sunset clause for regulation could not be implemented (Poel, 2006).

The EU's regulatory framework on electronic communications, though providing a harmonised set of regulatory measures across member states, also leaves some room of discretion for national policies in implementing the relevant directives. These policies can take account of the different national setting and points of departure, with emphasis either on service based competition or on facility based competition. The different options entail also different investment incentives. For instance, there are considerably different approaches regulating the incumbents wholesale access products such as bitstream access (Baake and Preissl, 2006). Sweden uses a retail minus approach for setting the wholesale access price, while Italy uses historic costs for this. In the Netherlands it is not regulated at all, with the justification that there is already a sufficient degree of competition in the market due to alternative platforms for broadband access.

The economic literature has contemplated the case that inappropriate access regulation has negative effects on infrastructure investment. This is in particular the risk when regulators cannot ex ante commit to specific ex post prices. Gans and King (2004) show how investment incentives can be improved through 'access holidays', i.e. a limited period without access regulation. Such a perspective however is likely to create substantial dispute, as there are strongly conflicting interests involved. Although the way access products are priced have an influence on the investment incentives, the EU regulatory framework is silent on the investment incentives for either the incumbent or the new entrant. What is clear is that the EU regulatory framework will stay firmly based for the foreseeable future on the notion of access

price regulation and the notion of unbundling. This becomes clear in the debate about 'regulatory holidays' on more advanced broadband access technologies such as VDSL⁵. The German parliament has recently passed legislation that opened up the possibility that investment into VDSL by the incumbent would be temporarily not regulated. The interpretation is that VDSL would open up a new market for advanced services that were not feasible with the previous technologies. The EU regulatory framework in principle allows for regulatory exemptions in new markets. However the EU Commission disagrees that this applies in this case and therefore has started an infringement procedure against Germany for non compliance with Community legislation.

This discussion may be related to the new regulatory trends in the United States. A regulatory turnaround occurred during 2003, when one of the incumbent regional telecommunications operators won the legal case for refusal to unbundling. The obligation for unbundling was phased out since then. The regulatory authority, the Federal Communication Commission, has shifted its emphasis on the concept of infrastructure competition instead, renouncing on regulating broadband access and wholesale markets (Nuechterlein and Weiser, 2005).

3. Regulation and investment in fixed broadband access

Broadband access has been identified as a key infrastructure for benefiting from the productivity enhancing features of information and communication technologies. Thus widespread access to broadband is high on the political agenda. Fixed line telecommunications networks, along with cable TV, are currently the main provider

⁵ VDSL stand for *Very high data rate DSL*.

of broadband access. Other platforms, such as optical fibre or spectrum based technologies, including third generation (3G) mobile telecommunications systems or *Worldwide Interoperability for Microwave Access* (WiMax) still play a minor role. Thus only digital subscriber line (DSL) and cable modem technologies are considered in the following.

DSL is the broadband access mode via the conventional public switched telephone network (PSTN) based on the copper pair local loop. On this platform the incumbent fixed line firm has a natural advantage, as it owns this network. To allow other firms access to network elements, regulation requires the fixed line incumbent to unbundle network elements and lease them at regulated prices.

Cable modem is a technology that provides broadband access over the cable TV networks, which originally were built to provide TV broadcasting services only. To provide broadband services, a cable network needs to be upgraded to enable it for a two-way traffic flow. Both cable modem and DSL technologies share a fixed amount of transmission capacity between a multitude of users. But because cable networks tend to be spread over a larger area than DSL services, cable modem suppliers have to make particular care in redesigning the network in order to give a service performance that is comparable to DSL.

The scope for providing broadband services varies considerably across countries. First of all, there is an issue of availability. PSTN infrastructure is present in all countries and also the potential for upgrading to DSL services. Countries differ in the degree of coverage. The transmission performance for DSL services decreases with the length of the local loop, i.e. the distance between the so called central office and the user. The maximum distance for good performance is in the order of two to five kilometres. Typically a large share of existing subscriber lines, especially in urban

areas, satisfy this criteria. European countries differ quite a lot along those parameters, but overall the ability of DSL as primary tool for broadband provision is undisputed. This is not so for cable. Full cable TV coverage is available only in very few countries, while there are several countries, like Italy and Greece, which do not have cable TV at all. As will be seen later on, this also limits the scope for developing inter-platform competition for broadband access between DSL and cable networks.

The regulatory treatment for broadband access via DSL is very different from that of cable. This difference is very much related to the type of services that the networks were built for initially. PSTN voice services used to be provided by (regulated) monopolists. Even after sector liberalisation the incumbent firm remained regulated because of having “significant market power” in the relevant markets. The remedies include mandatory access to network elements at regulated prices. Cable networks, which are in competition with other technology platforms to provide broadcasting service such as satellite and terrestrial transmission, are subject to much less regulation. In particular, cable networks are not subject to providing mandatory access to network elements. This difference with respect to DSL is important for the development of broadband access.

The remedies adopted for incumbent PSTN firms are technically quite complex. In principle, incumbent firms have to give access to network elements at cost based prices to new entrants as they require them. Following the ladder of investment theory, four access products supplied by the incumbent can be identified⁶, and they are in the order of increasing degree of own facilities required by the new entrant:

⁶ See also European Regulators Group (ERG, 2005).

Resale: the new entrant simply retails the DSL product bought on a wholesale basis from the incumbent. Because it is only a resale, there is no scope for product differentiation with respect to the incumbent's service offering. This form of access requires little investment in own facilities.

Bitstream access: the incumbent installs a high-speed access link to the customer and then makes this access link available to the new entrant, to enable the provision of broadband services to customers. Bitstream access is a wholesale product that consists of the provision of transmission capacity in such a way as to allow new entrants to offer their own, value-added services to their customers. The incumbent may also provide transmission services to its competitor, to carry traffic to a 'higher' level in the network hierarchy where new entrants may already have a broadband point of presence. The investment of the incumbent in own facilities therefore depend on the level at which the network is accessed. This also provides scope for some degree of product differentiation with respect to the incumbent's services.

Shared access: the incumbent continues to provide basic telephony business services to the customer, whereas the new entrant uses the high frequency channels on the same local loop to provide broadband services. In this case the new entrant has to install its own transmission equipment in the central office where the two types of traffic are split along with the network elements necessary for backhauling the traffic.

Full local loop unbundling (LLU): the new entrant rents the whole line from the incumbent for its exclusive use. The customer therefore ceases any business relationship with the incumbent operator. Also here the new entrant can install its own transmission equipment in the central office or elsewhere and also has to provide all network elements necessary for backhauling the traffic. This mode of access is associated with the highest level of investment in own facilities.

Depending on the regulatory context, different ways of unbundling network element can be distinguished. The European Commission (2006) considers resale and bitstream access as service based competition, where the recourse to own infrastructure by the new entrant is still quite limited. In exchange of this reduced investment, the new entrants have only limited ability to differentiate their product from the incumbent's. Shared access and LLU refer to facility-based competition. This requires significantly more investment in infrastructure, typically all the backbone down to least until the central office. In this case however, the service performance is largely under the control of the new entrant.

European access regulation is permeated by the idea that new entrants should be assisted to enter in a way that foresees initially limited investment, but then it should increase. In other words, entry should first be service based and then increasingly switched to own facilities. With dynamic access regulation, access prices for the different services should be designed in such a way that there are incentives for the new entrants to increasingly move up the rungs of the investment ladder. If incentives determined by prices are correct and firms would climb up the rungs of the ladder, then one would observe a decrease in the market share of access lines for resale and bit-stream access paths, while shared access and LLU should increase over time. Figure 1 shows the actual trends of the shares of the different access products within the EU, by aggregating data for the member states. From this emerges the following picture. Resale is declining, while bit-stream access is fluctuating. This would be in line with the ladder of investment theory, as firms would appear to climb up to the type of entry that requires more investment. This is also confirmed by the increasing trend of the shared access mode. Finally, LLU that appeared to be stagnant also shows signs of being on an increasing trend.

Figure 1

In figure 2 the access modes are aggregated as mentioned above: service based competition refers to both resale and bit-stream access, while facility based competition refers to both shared access and full LLU. The figure clearly shows the steadily increasing share of the facility based access mode. As this is mainly due to shared access, it would suggest that new entrants focus on broadband access, while leaving traditional voice PSTN to the incumbent. This may be rational, as it would induce new entrants to concentrate on the business with the highest profit margin and growth potential. Moreover, as traditional switched voice is increasingly replaced by voice over IP (VOIP), new entrants may capture also the voice market this way. This strategy is supported by the regulatory obligations for incumbents in some countries to supply “naked DSL”, i.e. unbundled telephone lines where the customer takes the broadband channel only within the local loop, but not the narrowband channel which would be used for switched voice services.

Figure 2

Apparently this picture of increased facility based competition lends support to the ladder of investment theory. Prices of the different modes of access are staggered in a way to induce firms to act according theory. But in spite of this trend towards facility-based competition, ultimately there is little overall investment. It is in particular new entrants that appear to display a poor level of investment. Figure 3 shows two lines. The first is the market share of the new entrants in total DSL lines in the EU. It

clearly shows an increasing trend. The second line shows the share of new entrant's investments in the total investment for the fixed line market in the EU. The new entrant's investment share is stagnant, or certainly not increasing in the same way as the DSL market share is, and in any case out of scale with the market share in DSL lines. New entrants are not investing as much as one would expect from their position indicated by the market share. This would suggest that new entrants are climbing up the ladder to facility-based competition, but without doing much of the investment in infrastructure that is entailed by in theory. This may be rational if the level of prices for access products is below the actual cost the entrant would have to pay for replicating the rented asset. In other words, the incumbent's asset would be under-priced. But asset under-pricing also reduces the investment incentives for incumbents.

Figure 3

The hypothesis of incumbent's asset under pricing is supported by the observation that overall investment in the fixed line sector is not increasing either. Figure 4 shows the total investment in the fixed line sector. It declined from EUR 25bn in 2001 to slightly around slightly below EUR 15bn in 2003 and increased then marginally in 2004. This needs to be put in relation with the market trends for fixed line revenues. Incumbents are faced with a declining market share on the overall PSTN revenues and one can understand that the investment level of the incumbent should be declining as well. But this shortfall of incumbent's investments is apparently not compensated by investment from new entrants, and overall investments are declining.

Figure 4

Anecdotal evidence suggests that there is little incentive for new entrants to make investments in alternative infrastructure. On the contrary, there are cases like Fastweb in Italy, which initially started out with building an optical fibre access network, but in more recent years changed its business strategy to renting unbundled local loops from the incumbent Telecom Italia. The consequence of reduced investment in infrastructure is the slowing down of the diffusion rate for broadband access. If there are little alternative platforms for broadband access other than DSL, then the rate of diffusion is determined by investments in DSL technology. In fact, from the market data emerges that the share of DSL technology in total broadband access technologies is steadily increasing. Figure 5 shows the market shares of the different broadband access technologies in the EU. It shows that the trend is heavily tilted towards DSL technology, which by the end of 2005 accounted for about 80% of the broadband access lines. The focus on a single access technology may have two fundamental drawbacks for the diffusion of broadband access. First, the investment level is crucially affected by the incentive for the incumbent PSTN operator. Second, the benefits for platform competition are foregone.

Figure 5

Mandatory unbundling appears to be rather a substitute than a complement for investment in broadband infrastructure. It reduces incentive to invest in both DSL technology by the incumbent and alternative platforms by new entrants. In fact, also in this segment investment activity is sluggish. From the London Economics (2006) study emerges that this amounts to only about a tenth of the investments of the fixed

line sector. But even at this level it is on a declining trend. The key to restore investment incentives would be to modify the regulatory environment, and in particular to encourage true platform competition. This latter effect may be quite important. There is empirical evidence (Denni and Gruber, 2006) for the US that inter-platform competition has significant positive effects on the diffusion of broadband access. Intra-platform competition, based on the same platform, instead has ambiguous effects.

It seems that the origin of the investment problem is access regulation. The interpretation in the present context is mandatory unbundling affects incentives to investment both to the incumbent and the new entrant. Moreover, the favourable access regime for new entrants on DSL technology also negatively affects investment for alternative technologies such as cable modem. To counterbalance this trend towards a single platform, prices and conditions for wholesale DSL access products should be reviewed, but also more measures should be undertaken to promote alternative systems, such as optical fibre systems or spectrum based platforms like WiMax. That such policies supporting greater variety in access systems is possible is shown by the case of South Korea, where the share of DSL in total broadband access technologies is declining. Figure 6 shows that the DSL share has declined to close to 50% of all types of broadband access, with cable modem keeping its share roughly constant, whereas alternative platforms are increasing steadily their shares. South Korea happens also to be among the top performers worldwide in terms of broadband penetration. Lee et al. (2003) and ITU (2003) illustrate how fierce infrastructure competition led to high quality services at low prices, facilitating hence widespread diffusion. Unbundling of local loops became mandatory only in 2002, at a time when South Korea already had a high broadband penetration rate. The high penetration rate

was triggered off in the first place by high incentives to invest in the development of cable modems, but also alternative wireless based access technologies. This would suggest that the lack of access products from the incumbent induced the entrants to invest in alternative platforms.

Figure 6

As speeding up the roll-out of broadband infrastructure is still one of the key items on the “Lisbon Agenda” for creating Europe as the most advanced economic region in the world⁷, this suggests that there are considerable regulatory challenges for Europe in the field of PSTN. A continuation of current regulation is unlikely to be of help. Deregulation in the fixed line broadband sector seems to be of order instead.

The economic literature has shown that investment incentives can be improved through access holidays. Although measures such as access holidays may not be the first best regulatory solution, they could prove nevertheless valuable and would probably be less controversial with countries where there is already a certain degree of platform competition. A minimum of platform competition would help to mitigate the risk that incumbents expose consumers to the abuse of market power. Moreover, access holidays would compel new entrants to invest in alternative infrastructure. Thus regulation could be confined to countries that are based on a single access technology. It may then be up to the national policy maker to assess whether the challenge may be worth it. The potentially negative impact on competition of reduced

⁷ See for instance the European Commission’s Communication to European Council in Spring 2006. “*Time to move up a gear. The new partnership for growth and jobs*”

regulation may be mitigated by supplementary measures on spectrum, such as speeding up of spectrum assignments for broadband access networks. Figure 7 shows the diffusion of the different broadband platforms in the EU member states. With for instance, by choosing a cut-off point where the DSL platform has less than 70 or 80% of the market, there are quite a large number of countries where alternative broadband access technologies are available; there seems to be scope for deregulation.

Figure 7

4. An example for inter-platform competition: mobile telecommunications market

In the previous section we have seen that facility based entry in the DSL market is ultimately dependent on having access to at least a portion of the incumbents facilities at the local loop level. But genuine infrastructure competition can only be achieved through an alternative infrastructure that allows for an alternative access at local loop level. This could be achieved even with the same technology, provided the infrastructure is replicated down to the local loop level, without relying on assets of the incumbent. The mobile telecommunications market can be seen as an example of genuine facility based entry, to be contrasted with observed entry mode in the fixed line market.

With mobile telephones the local loop is constituted by a wireless connection. This has a considerably lower cost of replication than for instance a fixed local loop connection. Nevertheless, only after some time the mobile market has seen the development of vigorous facility-based competition. Market structure has developed from the monopoly/duopoly of the early days to a typically 3 to 4 firm industry. The

sector can thus teach some interesting lessons about the role of facility-based competition.

The early days of the UK experience give a very neat example of the roles of service based competition and facility based competition (for details see Gruber, 2005). The main facts are sketched in the following. The UK was a relatively late adopter of cellular mobile telecommunications. The UK government announced only in 1982 its intention to grant licences for cellular mobile services while this service was available already in several countries. However, the delayed start allowed the UK to learn from these experiences. The government did not focus on technological issues, but it concentrated on introducing competition into the market. The introduction of cellular telecommunications happened in a context when the government led by Margaret Thatcher was implementing a general privatisation and liberalisation programme for network industries in the UK, including telecommunications. The duopoly model was already in operation in fixed line telecommunications. Identical mobile licences were given to Cellnet (BT) and Vodafone. The government thought that the obligation to vertically separate the provision of network infrastructure from service provision to retail customers would increase competition in the market. Thus neither of the two firms was allowed to retail voice services directly. Services on the networks could only be sold through “Service Providers”. These restrictions on vertical integration were aimed both at avoiding exploitation of a dominant market position and at providing as much as possible competition.

The service providers had a relatively simple role. They acquired customers and billed them for the services, retaining a commission of the invoiced revenues. In spite of the ban on direct sales, either firm could set up separate subsidiaries to act as service providers, provided that these associated companies did not receive a more

favourable treatment than any other independent service provider. By the end of 1985, there were 39 approved service providers in the UK; out of these, 12 sold Cellnet service only, 17 sold Vodafone service only and 10 sold service from both firms. Both firms also had their own associated service provider. However, the service provider business was highly competitive and with a very low margin. Subsequently, a wave of consolidation set in and marginally profitable service providers were acquired at high prices. By 1993, the top 10 Service Providers accounted for well over 80 per cent of the total mobile customers.

The fact that mobile service prices stayed at the same level until 1992 was a clear indication that firms did not compete on price. Over the whole duopoly period (1985-1993) both operators charged the same tariff for rental and for calls. Prices did not fall over the eight-year period and hence the benefits of productivity increases, which undoubtedly occurred, were not passed on to users of cellular services. To step up price competition, the UK government proposed the issuing of additional mobile telecommunications licenses at the beginning of 1989. These new services were referred to as Personal Communications Networks (PCN). At that time the government did not expect that firms active with PCN would compete directly with the existing cellular mobile telecommunications firms, since the facilities provided by the assumed low cost network seemed unlikely to be sufficiently comprehensive for professional users. Cost reductions could have been achieved by omitting some important features intrinsic to the existing cellular systems. The driving idea behind PCN was that the mass market needed small, light, hand-portable phone-sets, with a long battery life and low prices.

The existing facility based mobile telecommunications firms were excluded from the contest, since awarding PCN licenses was supposed to increase the level of

competition in the mobile market. The government issued three licenses at the end of 1989 of which two actually took up service. The new entrants immediately made investments in own infrastructure. Ultimately all of them adopted GSM technology. At the same time the UK government dropped the obligation to use service providers. The additional facility based entry had definitively a strong effect on price competition. While until 1992 the two mobile telecommunications firms kept prices at the same level, the additional two entrants forced incumbent firms to revise their pricing strategy. The price cuts led to a strong increase of subscribers. In terms of market shares of subscribers for the firms, there was a trend to convergence during the 1990s, and by 2002 all firms had about the same market shares, with all firms having their own network infrastructure.

This example of evolution of market structure in the UK is quite typical for most European countries. Prices have seen strong declines as a result of infrastructure competition and subscriber growth has been very strong. Regulatory challenges persist also in this sector, but on other issues than in the fixed line sector. Market power on call termination for own customers may require continuous regulation, as do other services such as international roaming. But in any case, regulation in mobile services was rarely as intrusive as to allow new entrants to have a claim on the assets of the incumbent, except with the case of mandatory national roaming. This measure was used in some countries as a temporary device to help new firms to enter the market, but with a well-defined obligation to construct an own network infrastructure. Investment incentives were thus maintained for all firms in the mobile telecommunications market. Figure 8 shows the investment shares of new entrants is very much in line with the market share in terms of subscribers.

Figure 8

Facility based competition in the mobile sector has shown to be an important factor for subscriber growth. This vigorous competition should also help to maintain the incentives for investment. While undergoing the same gyrations in investment as the fixed line sector during the years of the financial boom and bust cycle, the sector resumed investment after 2003, and mobile sector investments have overtaken the fixed line sector as figure 9 shows. This can be seen as evidence in support of the hypothesis that only genuine facility based competition with own infrastructure preserves investment incentives for both incumbents and new entrants.

Figure 9

5. Conclusions

Regulatory reform in telecommunications, like in other network industries, has been inspired by the concept of open access regulation to bottleneck elements in the infrastructure. Competitive access was seen as the means for eliminating the “deadweight loss” from monopoly and to establish efficient service provision in fixed line telecommunications. Cost based access pricing regimes were put in place mainly to favour competitive entry. While successful in attracting entrants, the pricing regime seemed to negatively affect long-term incentives for investment. For the EU countries, this seems be particularly relevant in the fixed line telecommunications segment where along with the reduction of the market share of incumbents also their level of investments has declined. But the investment level of new entrants has not increased to the same extent. Certain provisions of access regulation, such as

mandatory unbundling, seem to have become rather a substitute for investment by new entrants than a complement. Regulations on access also seems to have depressed the investment incentives of the incumbents and the incentives to invest in alternative technological platforms.

In order to restore incentives for investment in the view of expanding broadband access, a review of certain access regulations seems to be necessary. Regulatory holidays, in particular in contexts where there is already some degree of network competition, could be an option. The advantages of genuine facility based competition with an own infrastructure may be illustrated with the case of mobile telecommunications. There access regulation is much less intrusive, while investment levels have kept up and the relative shares of investments by incumbents and new entrants are much closer to the respective market shares.

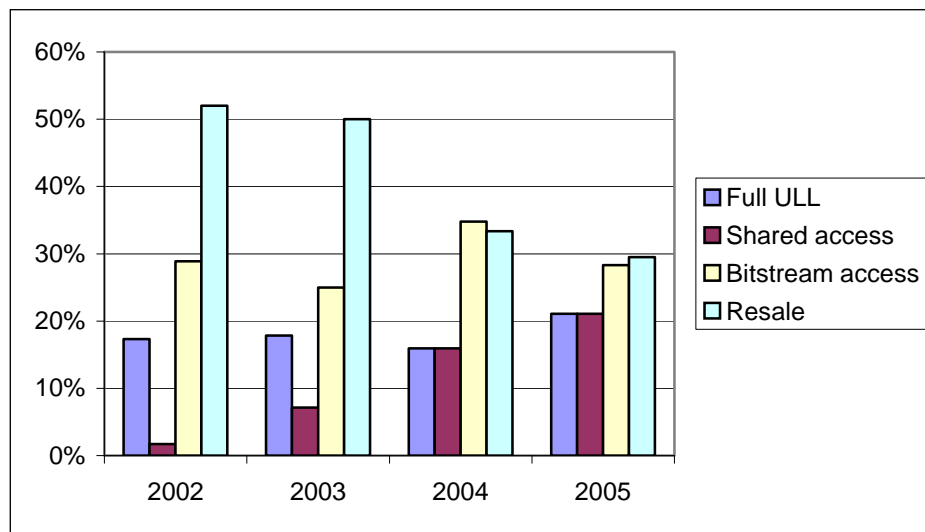
Reducing access regulation in the fixed line sector may require a country specific approach, as there are important differences across countries. While a proposal abandoning mandatory unbundling may be quite straightforward to implement in countries where platform competition is present, this could be more complex those are equipped with only one broadband platform. It is then up to policy makers to compensate a reduction in regulation with measures to promote platform competition, such as the accelerated issuing of spectrum licenses. In any case, regulation should not be so intrusive to provide new entrants a claim on assets of the incumbent.

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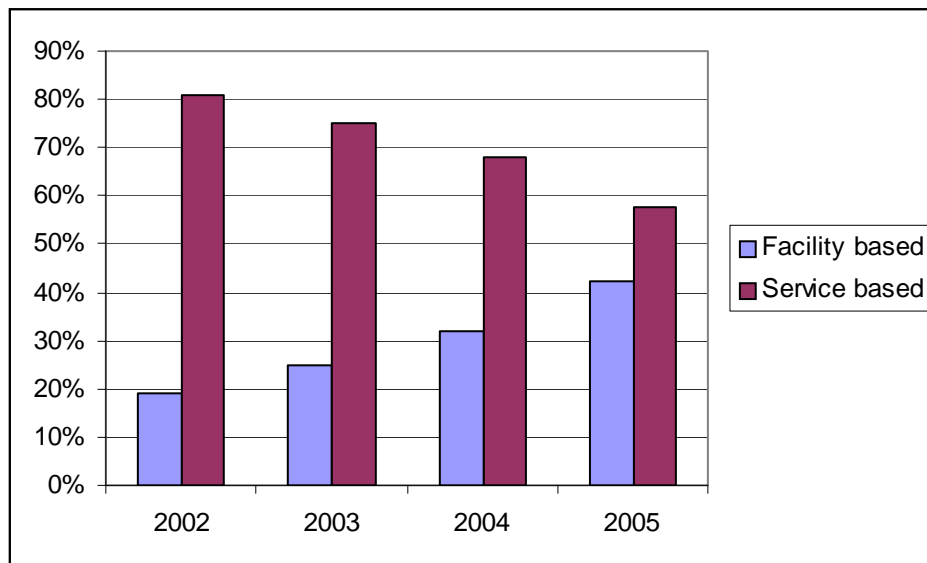
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**Figure 1. Shares of different access products for fixed line telecommunications
(25 EU countries)**



Source: author on data from European Commission

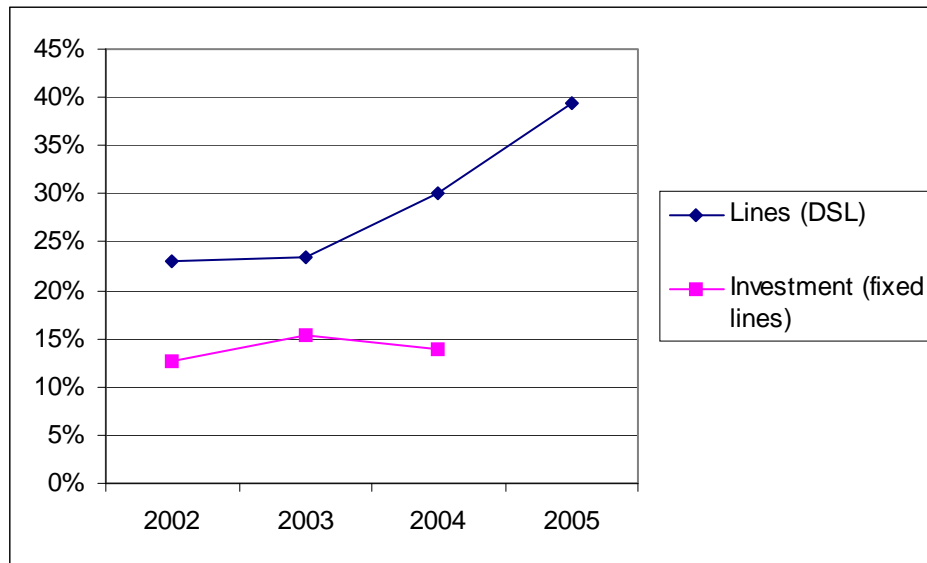
Figure 2. Share of service based and facility based entry in the fixed line telecommunications market (25 EU countries)



Note: access modes are aggregated as follows: service based competition refers to both resale and bit-stream access, which facility based competition refers to both shared access and full LLU.

Source: author on data from European Commission

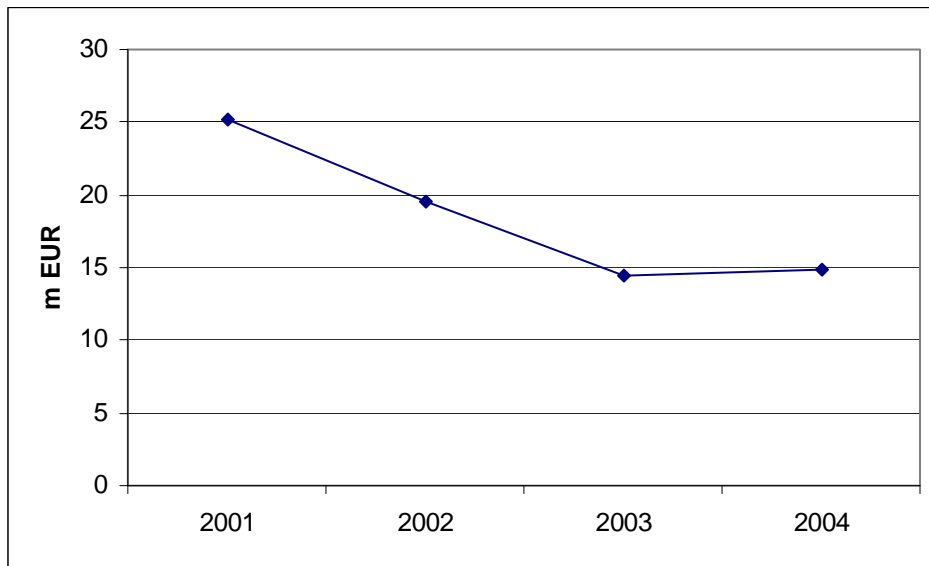
Figure 3. The new entrant's market share for DSL lines and investment in the fixed line telecommunications market



Note. The upper line is the market share of the new entrants in total DSL lines in the EU. The lower line line shows the share of new entrant's investments in the total investment for the fixed line market in the EU.

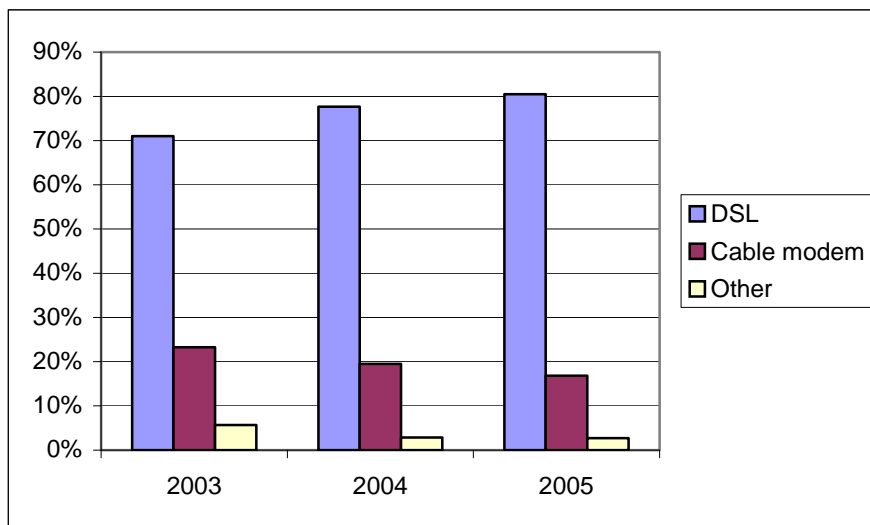
Source: author on data from European Commission (lines) and London Economics (investment)

Figure 4. Total investment in the fixed line sector for the EU countries



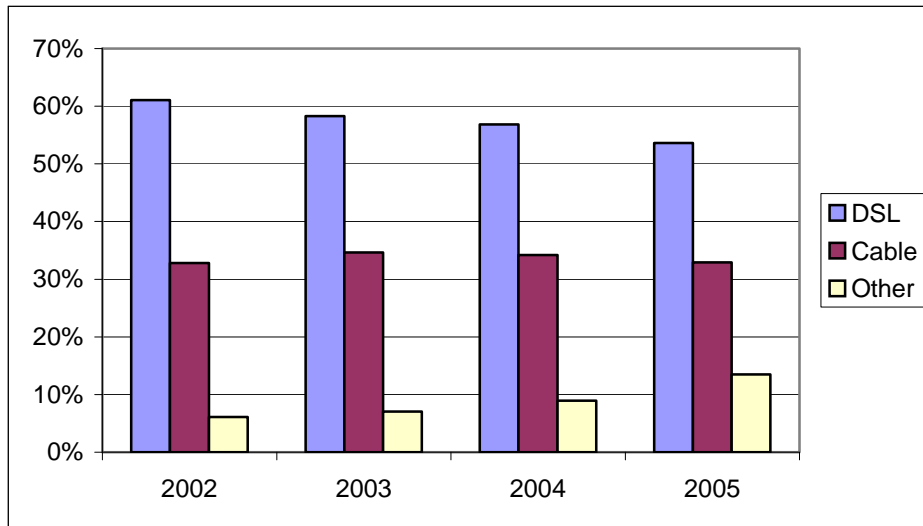
Source: London Economics

Figure 5. Shares of broadband access technologies for the EU countries



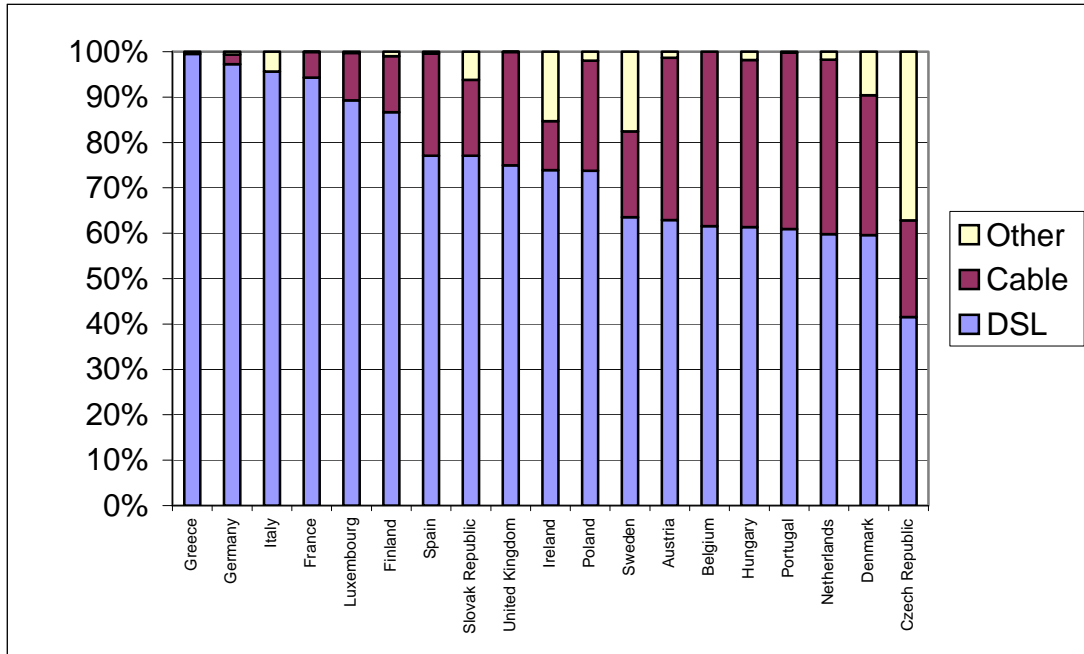
Source: European Commission

Figure 6. Shares of broadband access technologies for South Korea



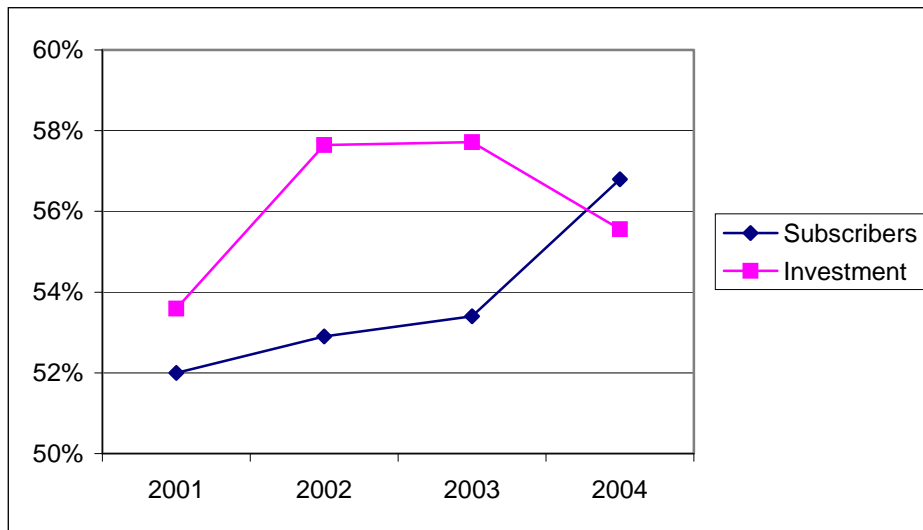
Source: OECD

Figure 7 Shares of broadband access technologies for EU member states (June 2006)



Source: OECD

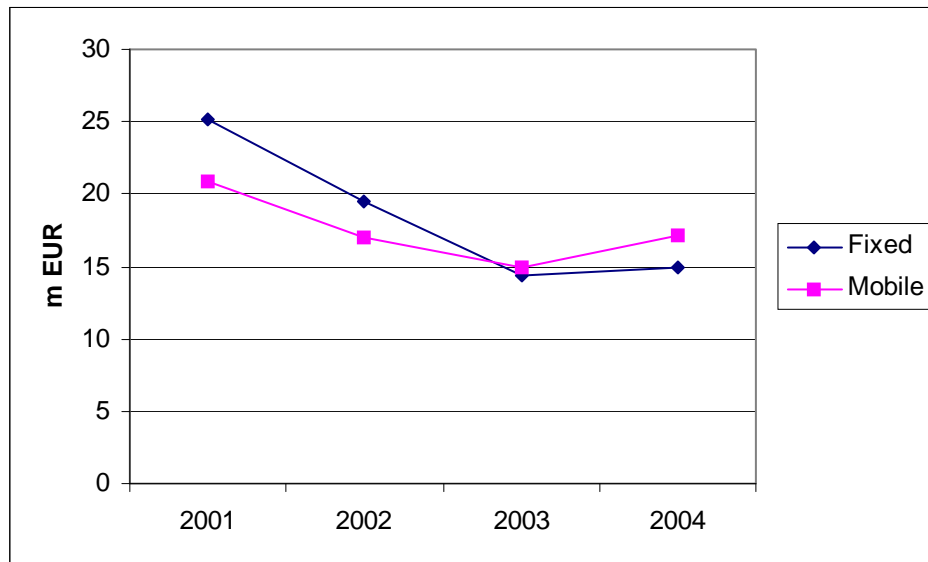
Figure 8. The new entrant's market share for mobile subscribers and investment in the mobile telecommunications market



Note. The upper line is the market share of the new entrants in total mobile telecommunications in the EU. The lower line shows the share of new entrant's investments in the total investment for the mobile telecommunications market in the EU.

Source: author on data from European Commission (lines) and London Economics (investment)

Figure 9. Investment in the fixed and mobile telecommunications sector in the EU member states (June 2006)



Source: London Economics