Infrastructure-Based Versus Service-Based : Competition In Telecommunications

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Infrastructure-Based *Versus* Service-Based Competition In Telecommunications (*)

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Abstract: Unbundling of the local loop (ULL) has seen quite different "success stories" in the various countries across Europe. Although the obligation for the provision of ULL was implemented in the regulatory framework early and mostly parallel to other means of liberalisation, national implementation has been rather heterogeneous. One question of decisive importance for national regulatory authorities (NRAs) was whether to foster service-based competition in the first phase of liberalisation or to focus on infrastructure-based competition. The different NRAs chose to head down different roads. This paper analyses whether the strategy of NRAs has had any mid-term effect on the economic welfare created in the communications markets. It indicates that infrastructure-based competition has a positive effect on innovation. Moreover, infrastructure-based competition appears to be more important for business customers than for residential clients. On the other hand, service-based competition lowers call prices and appears to be more important to residential markets. The results of this study point out the importance of a balanced approach to both types of policies
Key words: competition, telecommunication, ladder of infrastructure, ladder of investement, regulatory policies.

■ Introduction and types of competition

The issue researched in this paper goes back to the fundamental questions discussed when markets for telecommunications services were opened up, namely what kind of competition delivers more favourable results – infrastructure or service-based competition? Today, this is still (or again) an intensively debated issue as far as policy changes, new business models (for example, virtual operators) and new – especially broadband – technologies are concerned.

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Regulatory policies in numerous countries have developed in very different ways. The issue of unbundling was raised in the United States in 1996 (CRANDALL, 2005, p. 7). Prior to that point the competitive landscape had developed mainly through indirect access and resale in voice telephony markets (VOGELSANG, 2005, 2002). European countries followed a joint approach to market opening. Some of the countries started before the joint policy took effect, notably with indirect access for international calls (for example,. Sweden in 1993).The UK was an exception with its duopoly policy, which was implemented as early as the 1980's. When the 1998 framework was implemented in the member states [1] many countries saw the emergence of operators offering voice communication based on interconnection. Many incumbents criticized this approach as arbitraging [2]. Whereas interconnection was a fundamental part of the joint framework, access competition through unbundling local loops was compulsory only after its introduction by EU legislation at the end of the year 2000 [3]. With that step, further business models have arisen based on line sharing, bitstream access and most recently "naked DSL", for example [4]. The move towards all-IP networks and the ability to interconnect/get access to such NGNs extends the debate to net neutrality (See NICHOLLS, 2006; VON SCHEWICK, forthcoming 2007).

These different types of business models have re-launched the debate as to what sort of competition is sustainable. This debate also has to be seen in the light of the contents of the European framework, according to which national regulatory authorities should encourage efficient investment in

1 See the implementation reports from the EU commission with respect to the development of competition:
http://europa.eu.int/information_society/topics/telecoms/implementation/ index_en.htm

2 However, for these business models, the issue of efficient infrastructure investment can also be discussed in relation to the different levels of the network hierarchy where interconnection takes place and the extension of investment in double, single and local interconnection over time as a stepwise extension of alternative networks, see Piepenbrock/Schuster (Eds.): *Anreize für Infrastrukturinvestitionen bei der Zusammenschaltung in der Telekommunikation*, 2003.

3 Regulation No. 2887/2000 of the European Parliament and of the Council on Unbundled Access to the Local Loop: http://europa.eu.int/ISPO/infosoc/telecompolicy/en/regullfin-en.pdf. Compared to directives, which have to be transposed into national law, regulations are directly "enforceable".

4 CAVE, 2004. It seems that some countries are following the approach of the ladder of investment; see ERG (05)23, 2005, Annex A "Country Studies":
http://erg.eu.int/doc/publications/erg_05_23_broadbd_mrkt_comp_annex_a_p.pdf

infrastructure and promote innovation [5]. The discussion is now centring on terms like "ladder of investment", "emerging markets" and "access holidays".

Today's regulatory framework already offers several ways of fostering competition and regulators have chosen different strategies in the past to open up the communications markets. Companies have also chosen different strategies to enter the markets, based on the economic principles laid down in regulatory decisions. These various regulatory means ("toolbox") for opening markets and networks have become intensively debated issues between former monopolists, regulatory bodies and competitors. The main point has been whether infrastructure or service-based competition would lead to lower prices, more differentiated and innovative products and improved services for consumers. The cost of regulation is an additional point (ELLIG, 2005).

A frequently discussed concept is the ladder of infrastructure competition, which argues that new entrants may enter the market based on a wholesale product where they only cover minor elements of the value chain (such as resale) and then – once the customer base grows and financial means become available – move on to "higher rungs" of the ladder. This implies that operators supply more elements of the value chain themselves by building their own infrastructure and acquiring only the residual infrastructure from the incumbent's wholesale department. This includes a move for the operators from service to infrastructure-based competition. Hence, by implementing this ladder, both infrastructure and service based competition is promoted (VOGELSANG, 2005, p. 58).

■ Empirical analysis

In order to answer the question, whether infrastructure or service-based competition should be promoted by NRAs, we first examined which countries followed which type of policy. This paper focuses on the EU-15 countries (the countries belonging to EU before May 1st, 2004) since these EU members all had a similar regulatory framework. The categorization between service and infrastructure-based competition (specifically in light of the issue

[5] See, for example, Art. 8 para. 2 of the Framework Directive: Directive 2002/21/EC of the European Parliament and of the council of March 7th 2002 on a common regulatory framework for electronic communications networks and services (Framework Directive), *Official Gazette,* no. L 108/33 of April 24th 2002.

of ULL) in this paper is based on the principle that, from an economics point of view, the replication of the local loop does not make sense [6] and therefore only the use of the last mile is a relevant differentiating factor between service and infrastructure-based competition. If an operator needs more elements of the access network than only unbundled local loops, as is the case, for example, with bitstream access or simple resale, we consider this kind of competition as service-based competition [7].

The selection of the EU-15 implies that the toolbox at hand for the regulators has been largely the same and that NRAs have had the opportunity to focus on infrastructure-based competition (mainly ULL) or service-based competition (resale, indirect access [8], etc.).

We divided the countries into two different clusters based on statistics regarding the success of the different regulated products and the date of introduction for these products, as well as the ECTA Broadband Scorecard.

- Group 1: infrastructure-based competition has been the main objective of the NRA visible in its policy and decisions.
- Group 2: the NRA has focused on service-based competition to a greater extent.

For clustering, this papers looks at main indicators describing the performance of competition in order to identify the type of policy NRAs have pursued [9]. This method is based on the assumption that NRAs are following definedregulatory goals and policies by using the toolbox to foster the two

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[6] CAVE, 2004, p. 8. This assumption may be debated in light of the NGN discussion (see VON SCHEWICK) and the development of competition in the USA in recent years after major parts of the unbundling regime was abolished, see CRANDALL.

[7] In our opinion the fact of complete ownership alone does not constitute a relevant means of differentiation. The demarcation point between service-based and infrastructure-based competition is often contested. The Danish regulator, for instance, considers only the full replication of the whole infrastructure including the last mile as infrastructure-based competition and all forms of network access as service-based competition; see: HENTEN & SKOUBY, 2005, p. 2. The triennial review in the USA also changed the picture of regulation and the assessment of the contribution of service *versus* Infrastructure-based competition.

[8] We are aware that this classification can be critical for those companies who invest in certain, but not in all parts of the infrastructure. Whereas a pure reseller can be easily allocated to service-based competitors, this is more difficult with indirect access operators and backbone providers, for example. Furthermore, we are aware that regulators might view their policy classification in a different way. We have consequently defined clear cut criteria whereby policy can be evaluated.

[9] Due to size limitations, the full results of the empirical study cannot be displayed here, but a longer version of the paper with all details can be downloaded from: http://www.psc-ag.biz.

different policy types either implicitly or explicitly [10]. For the empirical study, it is further assumed that the intentions of the NRA have had a direct impact on market development, i.e. NRAs are successful in the implementation of their policies and that this is impacting market development. Using these indicators, countries are clustered according to whether they have focused on infrastructure or service-based competition.

The first indicator assesses how successful infrastructure based competition has been by describing the competitors' markets shares [11] with respect to access line competition and the proportion of service-based competition (resale and bitstream access) of all wholesale products [12].

The second indicator uses the competitors' market shares of local loops (both, line sharing and fully unbundled loops) and the market shares of all competitors in broadband markets (measuring the success of competitors).

The third indicator measures the success of competitors in broadband markets in relation to their share of the retail market. By looking at the proportion of infrastructure-based competition and thereby excluding CATV, the same analysis can be conducted for the DSL-market only, which gives us the fourth indicator.

A second way to quantitatively measure regulatory policy is by examining the date at which different wholesale products were introduced. Our research looked at the regulatory situation at the beginning of the millennium, as it takes some time from the introduction of the wholesale products until an outcome can be measured as far as competition in the retail markets is concerned. We used the dates of introduction of ULL and carrier (pre)selection services as the fifth indicator. Annex I contains the result of this clustering.

[10] For example, because the national Telecom Act contains a preference for a specific type of policy.

[11] We do not consider any other factors that could affect broadband penetration. For further information see FLAMM, 2005.

[12] ECTA Broadband Scorecard Q2/2005 (downloadable under www.ectaportal.com) and calculations of Piepenbrock Schuster Consulting AG.

■ The effects of regulatory policy on the competition situation

Price and penetration as measurements of competition and innovation

The study aims to determine which regulatory policy has had the greatest impact on competition with respect to measurable effects with regard to service or infrastructure-based competition. The clustering of countries is based on the analysis in the previous chapter. This chapter examines the output of regulatory policies (with the help of the clusters).

Regulation is put in place in order to generate positive welfare effects where marketsa alone would not tend to perfect competition. The problem is how to measure these welfare effects, as they can occur as consumer surplus, producer surplus, societal gains (i.e. increased tax income, better working conditions, etc.). The main aim of liberalisation in the EU was to increase overall welfare through lower prices, enhanced consumer choice, innovative products, etc. [13]. Therefore, we examined the welfare effects measured by the state of competition, which is defined through the price situation. This is based on the assumption that more competition reduces prices in the market.

Competition can also increase consumer welfare without reducing prices. This is achieved by innovation. Therefore, we also examine if there are differences in terms of innovation in countries according to regulatory policy. A typical assumption is that the innovation and penetration rates of new services and technologies correlate (see, for example, McNARY, 2001; ERG (03), 2005). Therefore, we measured innovation by the penetration rates of broadband uptake, as well as the uptake of ISDN [14]. The statistical method chosen is the t-test [15]. As the variance of the two clusters have different values for the variances, we carried out the heteroscedastic t-test.

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[13] Commission Staff Working Document, "Europe's Liberalised Telecommunications Market - A Guide to the Rules of the Game", from October 18th 2000.
http://europa.eu.int/ISPO/info-soc/telecompolicy/en/userguide-en.pdf

[14] See, for example, VON SCHEWICK with respect to different forms of innovation and their assessment with regard to the discussion on network neutrality.

[15] Confer to http://www.statsoft.com/textbook/stathome.html, "The t-test is the most commonly used method to evaluate the differences in means between two groups. For example, the t-test can be used to test for a difference in test scores between a group of patients who were given a drug and a control group who received a placebo. Theoretically, the t-test can be used even if

Effects on competition and innovation

Based on the indicators for penetration rates, price competition, price development from 2000-2004, as well as prices corrected with PPP (purchasing power parity), the outcomes on competition and innovation were calculated. The results are shown in the table in annex II. The test also includes prices adjusted for PPP. These results are more or less the same in terms of the prices before the adjustment, so the adjustment does not make any difference.

By comparing the computed mean values of the two groups, we conclude that prices are lower and penetration rates are higher in those countries with predominantly infrastructure-based competition. By using the t-test, we derive that the results are significant in most cases [16].

> Result 1: countries with predominantly infrastructure-based competition have lower overall prices and higher penetration rates and thereby more innovation.

Furthermore, there are higher penetration rates on average in countries with infrastructure-based regulatory policies, although these results are only significant for broadband markets, but not for ISDN. There is a risk of auto-correlation in this case, since the countries were clustered partially by the penetration rates, but as other factors were considered as well, this risk has been reduced.

> Result 2: analysis of penetration rates tends to indicate that infrastructure-based policies foster higher penetration rates. With regard to price levels in 2004, these are lower in countries with infrastructure-based policies. The results, however, are not significant for the residential baskets. The differences between the clusters are especially high for business customers.
> Result 3: there is an indication that infrastructure-based competition is of greater importance to business customers than to residential customers.

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the sample sizes are very small (as small as 10 for example; some researchers claim that even smaller n's are possible), as long as the variables are normally distributed within each group and the variation of scores in the two groups is not reliably different."

[16] There is one critical remark to be made though, and that is because of the relatively large variances. The reason for these variances is the small sample of countries included in the study. It is therefore advisable for the results in this study to be validated in future research using additional methods to those applied here. However, the results by comparing the means and the variances by using the t-test are nevertheless strong and, in several cases, achieve a confidence interval of 95%, so that the results in this study are to be seen as significant.

When looking at the prices in 2005, however, according to the 11th implementation report of the EU Commission, the results are – with one exception – no longer significant. When considering monthly rental charges for business customers alone, it is significant that prices are much lower in countries with infrastructure-based competition. As for OECD baskets and monthly rental for residential customers, prices are still higher in countries with service-based competition, but the results are no longer significant.

The changes which took place between 2004 and 2005 are elements of a long term process. Hence, a trend towards price harmonisation did emerge between the two clusters during the period 2000 to 2004 – although these results are not significant according to the t-test for the monthly rentals and for the national business and residential basket.

> Result 4: price differences between countries with mainly service-based and infrastructure-based competition.are diminishing throughout Europe.

In the period 2000 to 2004, the monthly rental went up by almost 30% on average in countries with service-based competition, while prices in countries with regulation focusing on infrastructure-based competition increased by only 3.9% (business customer) and 8.8% (residential customers). The increase in monthly rental prices was over-compensated by far in those countries with service-based competition. In fact, the prices for OECD baskets (which also include monthly rental) decreased by 12-16% over the same period in countries with service-based competition. In those countries with more infrastructure-based competition, OECD baskets decreased only slightly. This indicates that service-based competition is more important for residential clients, while infrastructure-based competition is more important for business customers.

> Result 5: there are clear indications that tariff rebalancing has gone further in the countries with service-based competition than in those with infrastructure-based competition.

Critical remarks

Some comments regarding the methods used in this study are called for.

In order to carry out the study, binominal clustering of the countries was effected. There are naturally measurable differences within the two clusters in some cases and conducting statistical tests with a binominal independent

variable is not optimal. The alternative would have been to rank the countries. Since it is very difficult to measure "better or worse" strategies, the significance of the results would not have been higher, since the clustering would only have been more arbitrary.

Another problem derives from the role of CATV, which has existed all of the time and has had a positive impact on competition, but has hardly been influenced or promoted by regulation. Therefore, assessing the impact of this alternative infrastructure with intermodal competition correctly is difficult. The same holds true for countries that have opened up markets at different dates and with other policies than those within the harmonized EU framework such as the UK. Policy changes, as well as different liberalisation starting points, can nevertheless influence the significance of the results, as, for example, the outcome of regulation in earlier years in the UK might still have an impact on communication markets.

Moreover, the sample sizes are rather small and the variances are in several cases are large, which is a problem in terms of the significance of the results. The results in this study consequently need to be considered with care and it is advisable to verify the results in future research by other methods or larger samples.

■ Analysis and discussion

Following on from the results, this section addresses issues in direct relation to the topic, especially in current regulatory discussions. The main findings are summarized in boxes within the text.

Types of competition

The empirical study has shown that infrastructure-based competition has led to significantly lower access costs and call tariffs for business customers and, to a slightly lesser extent, for residential customers in its early stages. However, call tariffs, as well as access costs for fixed line services (monthly line rental) have risen after a decrease for both customer groups slightly again over time in countries with infrastructure-based competition.

On the other hand, where service-based competition is fostered, infrastructure-based operators try to compensate for the loss in variable

turnover from call prices by sharply increasing line rental prices. This is done either by tariff rebalancing and/or by including call prices in the price of the rental ("bundling", "optional tariffs"). Sharply reduced tariffs for call prices mostly overcompensated for the line rental increases. Compared to infrastructure-based countries, call prices saw an overall steeper decline in service-based countries.

An interesting aspect can be observed in recent periods. Overall price structures in service-based and infrastructure-based countries tend to conform to each other and the differences begin to diminish. From our point of view, this can be traced back to the fact that most countries started with fragments of the ladder of investment and with the introduction of additional rungs, while market players have invested in further rungs. The benefits of both strategies are now beginning to evolve and compensate for the negative aspects of the other – reduced access costs from infrastructure-based competition are starting to be linked to low call tariffs from service-based competition. The task facing NRAs is to render all rungs of the ladder of investment operational in order to increase customer welfare.

Conclusion: with a stepwise introduction of the ladder of investment NRAs can focus on a specific liberalisation strategy. But only complete implementation of the ladder of investment will bring full customer welfare.

Infrastructure-based competition has led to lower prices. Competitors will undertake investment in their own infrastructure, only if the return justifies that investment. Therefore, business customers with a high impact on return on investment are those entities that benefited most from infrastructure-based competition. Residential customers often benefit from the investment made for business customers as the incremental costs for introducing residential offers are low once business offers exist. Furthermore, residential customers contribute to economies of scale and scope, and justify the additional investment in the residential market. This reduces both costs and, indirectly, the prices of the services. On the other hand, ULL-operators have incentives to raise prices once competition is reduced. Only a limited number of ULL-operators is able to survive in a market place, as sunk costs and necessary economies of scale reduce the ability and willingness of other players to enter the market. The market could consequently end up in a situation of oligopoly. In such a situation of imperfect and restricted competition, ULL operators have strong incentives to collude and raise prices as the lockin effects for consumers are significant.

In this situation, service-based competition could help to keep prices low if introduced as a complement to infrastructure-based competition. Products like indirect access and resale limit the flexibility of the ULL-operator to raise prices and are an efficient means of fostering competition with respect to end user prices [17].

> Conclusion: the complementary introduction of service and infrastructure-based competition limits the negative outcomes of either and supports the development of the positive elements of both liberalisation strategies.

Although, intramodal competition is not reflected in this study, one has to bear in mind the effects of such competition. Especially the different cost structures and the different technologies involved create some room in which competition can develop. NRAs need to be aware of the regulatory interdependence created by intermodal and intramodal competition. If one side of competition, i.e. one type of market player, is regulated, but the other side is not, the question arises whether this leads to a distortion of competition (such as the non-regulation of CATV-networks) [18].

> Conclusion: technology neutral regulation is a means of limiting the risks of distortions of intermodal and intramodal competition.

Management decisions and their influence on investment in infrastructure

As far as the influence of the NRA's decisions on how to open up the market to competition are concerned, the influence of operators must not be overlooked, as it is them who decide on the investments made. The following list contains key factors that influence management decisions.

Time to market

The liberalisation period was rather short, making time to market a key factor. In countries like the UK, France or Germany it was evident that once

[17] On the issue of complementary products and foreclosure in the NGN world (with respect to competition in the service and application layers) see VON SCHEWICK (forthcoming, 2007).

[18] A similar question was raised in a decision by the Dutch Competition Court, which annulled an NRA decision on mobile termination market analysis and remedies, thereby stating that regulation of the fixed market had led to the loss of any counterveiliing buying power against the mobile networks.

a clear decision was taken by the NRA on a specific access product, market players could focus on that product immediately (if the product seemed capable of forming the basis of a sound business plan). From this, we can derive the importance of the decision made by NRAs regarding access products for the market.

Product differentiation

During the liberalization process, the first goal of a company was to gain market share. The easiest way of achieving this was to duplicate the incumbent's products and offer similar products at a reduced price. Therefore, it is sometimes proposed to set lower prices for products at lower rungs of the ladder of investment. This would raise competitor's profits and give them the possibility to gather a customer base and to invest in infrastructure. NRAs then raise prices for low rung products of the ladder over time to incentivise investments in access products of higher rungs and to "force" competitors to invest in infrastructure. Yet one has to bear in mind that this proposal may distort competition for late entrants. Climbing the ladder of investment should be a possibility at all times as competition may not necessarily be carried out via pricing, but also via product differentiation.

Innovation

In telecommunications, mainly new technologies enable innovative services. Infrastructure-based companies form the basis of such innovations as they have control over the development and use of the infrastructure. The "enabler" of such new technologies can therefore either be new entrants or existing operators who place additional investments. One has to bear in mind that wholesale, especially access, obligations are not *a priori* preventing investment if access conditions are set at a competitive level and prices enable sufficient returns on investment. Therefore, wholesale obligations may even foster competition, penetration rates and the introduction of innovative services and technologies. This should be the case when the access obligations and thus the returns on investment of the wholesale business are neutral (economically) compared to the retail business.

Conclusion: market liberalisation follows the clear path of a product life cycle in competitive markets. Regulation paves the way for investors to enter markets and the products they intend to introduce.

Pricing

To be able to make the ladder of investment operational it is necessary that prices in wholesale markets for the different products are consistent but also that there are clear rules for migration from one product to another (ERG (05)23, 2005, exec. summary).

> "The imposition by national regulatory authorities of mandated access that increases competition in the short-term should not reduce incentives for competitors to invest in alternative facilities that will secure more competition in the long-term." (Recital 19 of Access Directive).

This means that NRAs need a long term view of their decisions. Disruptive changes in prices of products or conditions belonging to the ladder of infrastructure would automatically lead to a distortion of competition and discrimination either against first movers or late entrants. Higher prices over time would incentivise a stop of investment of new entrants and lead to a "closed user group" of first-mover-entrants with initially lower costs of entry (ELLIG, 2005).

We have seen (especially in France, the UK and Germany) that companies tend to invest in those access products that are available under defined conditions to be able to enter the market as quickly as possible and under a secure framework of conditions established by the NRA (BERGMAN, 2004). If NRAs want to incentivise the market to move towards infrastructure-based competition, a consistent pricing structure with regard to the ladder of investment is a pre-condition. Only under consistent conditions, investments are allocated efficiently. If companies see any additional profit in climbing the ladder of investment, they will do so. Therefore, the ladder of investment shall also allow for possible migration processes from one rung of the ladder to the next [19].

> Conclusion: a consistent pricing structure with regard to the ladder of investment is a prerequisite. To incentivise operators to climb the ladder, prices have to be set so that higher profit margins are possible for investments higher up on the ladder of investment. It is also necessary to implement effective migration rules.

With trend towards more competition law-based instead of sector-specific regulation, the consistent pricing within the ladder of investment may not be

[19] On the aspect of static *versus* dynamic competition and the last mile problem involved see also BANERJEE & DIPPON, 2006

upheld as NRAs will remove access obligations for certain rungs of the ladder. Therefore the consistency within the pricing structure of the ladder may be distorted. This will automatically cause some distortions for those companies that are just starting to climb the ladder of investment. It has to be clearly stated that under competition law, prices may include additional cost components compared to pure cost oriented prices. Therefore, significantly higher access prices under competition law should not automatically mean that there is abuse in the pricing strategy as the underlying cost principles are different.

Conclusion: the trend towards more competition law instead of sector-specific regulation could distort the consistency of prices within the ladder of investment. This, in turn, may have a significant economic impact on the business models of alternative operators.

Impact of new investments on new infrastructure (access holidays)

An issue receiving increased interest lately is the topic of access holidays and (closely related) emerging markets: Following the idea of the new regulatory framework from 2002 (European Commission, 2002) whereby competition law shall gain a more prominent role and sector-specific regulation shall gradually be reduced, former monopolists as well as some new entrants have argued in favour of granting access holidays for these investments, especially when referring to new access possibilities like fibre to the home (FTTH) or UMTS. The basis for this argument is laid down in recital no. 15 of the recommendation on relevant product and service markets (European Commission, 2003, recital 15).

The idea behind that argumentation is best described by Joseph Schumpeter (SCHUMPETER, 1918) where the interplay of invention as creative destruction and imitation leads to more competition. The aim is to foster innovation and to allow these companies to have some first mover advantages and therefore also a certain kind of (innovative) monopoly over a certain period of time.

Technological innovation and the rollout of new networks are accelerating in Europe. The EU Commission's recommendation on relevant product and service markets has defined markets that are susceptible to *ex ante* regulation. With markets and technologies changing quickly, the question

arises whether and how to apply regulation to these markets [20]. A more flexible approach than today's policy needs to be implemented in terms of the time and process for market definition, analysis etc. Otherwise, regulation will be too rigid to cope with the rapid technological changes of the future [21]. Thus, the market is confronted with a steadily changing situation and NRAs are not empowered to consistently resolve new market problems.

NRAs and the new framework will have to deal with the rigid idea of technological neutrality in the context of new markets. The market is already faced with inter and intra modal competition. This can be seen in the broadband market, where DSL operators, CATV-broadband operators and UMTS data card operators compete with each other. But it can also be seen in voice markets, where voice telephony is offered over traditional analogue/ISDN access lines, via indirect access or by mobile operators and VoIP services providers. In that area of potential conflict between traditional and new technologies NRAs will have to find a balance between regulation and the open market.

The EU commission has initiated a discussion of a revision of the current and the potential introduction of a new regulatory framework to become effective by 2009-2010 [22]. It is clear that access holidays will reduce competitors' ability to offer products and services to consumers. This study shows that this will have negative effects on prices and penetration rates, if neither infrastructure nor service based competition is in place to be able to cut prices and drive penetration, and thus, innovation. This paper clearly shows that in order to maintain competition, service as well as infrastructure-based competition needs to be in place to maximise consumers' benefits. Therefore, regulatory holidays for operators with significant market power who invest in emerging markets shall not be implemented. In order to financially consider the high risk of investment undertaken by operators with significant market power in new and innovative technologies, this is best

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[20] The German NRA recently launched a consultation on the concept of "new" markets, their definition and potential regulatory treatment:
http://www.bundesnetzagentur.de/enid/22bf816986c04634a7aed1b666c5315c,0/Regulierung_Telekommunikation/Neue_Maerkte_2jg.html

[21] For an overview see:
http://europa.eu.int/information_society/policy/ecomm/tomorrow/ index_en.htm
and on emerging markets:
http://europa.eu.int/information_society/policy/ecomm/doc/info_centre/public_consult/review/130706reviewpresentation.pdf, pp. 17-27.

[22] http://europa.eu.int/information_society/policy/ecomm/tomorrow/index_en.htm

achieved by allowing these companies an appropriate return on investment, which contains sufficient reward for the risks taken. Thereby, consumer interests are not harmed, the investing operator has enough incentives to invest and long-term competition can be enabled through access obligations.

Conclusion: access holidays will reduce consumer benefits. In order to create incentives for operators with significant market power, NRAs must consider the the specific risks related to the investments in emerging markets in making their decisions.

Summary

With the European Information society "i2010" initiative (European Commission, SEC(2005) 717) Europe has started an ambitious project. A recent study has shown the positive impact of the European regulatory framework on the new member states, which joined EU on the May 1st 2004 (HABERFEHLNER *et al.*, 2006). The present study considers EU15 member states and shows that the integrated approach to the information society is partly "on track". We have seen the different modes of infrastructure and service-based competition strategies harmonize as a growing number of countries enable competition on all rungs of the ladder of investment and the different market players diversify their market strategies. With this, prices tend to harmonize and Europe is stepwise developing towards a single market, which can be seen in the leveraging effects of the different strategies on prices.

As infrastructure-based competition leads to higher innovation and penetration rates, NRAs should foster inter and intramodal infrastructure-based competition when applying the framework. With convergence and new technologies like broadband and VoIP emerging, access at the levels of networks, services, applications and devices and own infrastructure and thus ULL will become increasingly important for operators to be able to have the possibility to differentiate their products from those of competitors and to attract new customers.

There are clear signs that infrastructure-based competition is more important to business customers and service-based competition is more important for residential customers. Therefore, if the majority of consumers are also to be able to benefit from competition then both liberalisation strategies will have to be in place – in a balanced approach.

The study has also shown that infrastructure-based competition does have an immediate (downward) effect on prices, which tend to remain stable afterwards. Under such circumstances, less tariff rebalancing will occur and alternative operators could refrain from investment in new infrastructure. On the other hand, service-based competition leads to significant tariff rebalancing in those parts of the value chain that are exposed to competition to a lesser extent. So these markets end up with higher access prices. In order to be competitive with infrastructure-based competition service-based competition needs much higher decreases in call prices to compensate for the increase in access costs.

On the other hand, if infrastructure-based competition alone is introduced, the risk of collusion remains in the sense that competitors only compete in the access market while increasing prices for other services. Hence both regulatory strategies are required. These results are consistent with the theory that price competition will take place in those parts of the value chain that are exposed to competition.

In most countries all rungs of the ladder of investment are now in place as regards the traditional network topologies. It seems that there is no pure and single way towards competition, but that markets need a healthy mixture of both, service-based and infrastructure-based competition. NRAs should consequently act in a stringent way regarding all rungs of the ladder in their pricing decisions. The market will react according to the strategic impact of the decisions made by NRAs, thus still relying on sector-specific regulation.

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Annex 1

	Indicator 1		*Indicator 2*		*Indicator 3*	*Indicator 4*	*Indicator 5*		*Conclusion*
	Proportion of ULL and LS	Proportion of BSA and resale	Proportion of ULL and LS	Fixed broadband retail lines market shares of competitors	% -age infrastructure-based competitors of all competotors (incl. CATV)	% -age infrastructure-based competitors of all competotors (excl. CATV)	Completed introduction of indirect access in mid 2000 (1)	Introduction of LLU (0 = after 2001; 1 = before 2001; 2 = before 1999	
A	3,4%	17%	3,4%	65%	85%	45%	100%	2	○
B	0,3%	21%	0,3%	49%	73%	3%	50%	1	--- (2)
D	5,3%	9%	5,3%	13%	72%	38%	50%	2	●
DK	5,5%	12%	5,5%	36%	83%	52%	100%	2	●
E	1,7%	25%	1,7%	44%	65%	16%	75% (3)	0	○
EL	0,1%	49%	0,1%	60%	53%	5%	0%	0	---
I	4,9%	15%	4,9%	30%	46%	46%	100%	1	○ (4)
IRL	0,1%	22%	0,1%	31%	35%	7%	100%	0	○
F	7,0%	23%	7.0%	52%	61%	56%	50%	1	● (5)
L	1,2%	10%	1,2%	26%	59%	25%	100%	0	---
NL	8,1%	0%	8,1%	56%	100%	100%	100%	2	●
P	0,9%	8%	0,9%	21%	92%	36%	50%	0	---
S	5,5%	14%	5,5%	60%	82%	52%	100%	1	●
SF	8,2%	10%	8,7%	36%	79%	68%	50%	1	●
UK	0,3%	65%	0,3%	54%	39%	2%	50%	1	○ (6)

○ = Service based policy; ● = Infrastructure based policy; --- = Indecisive

(1) The status is based on four categories of indirect access: carrier selection for local calls, carrier preselection for local calls, carrier selection for national calls, carrier preselection for national calls. Each category is weighted by 25%.

(2) Belgium, Greece, Luxembourg and Portugal were excluded as no allocation could be made.

(3) Completion for local calls in November 2000.

(4) The categorisation of Italy is due to the delay of the introduction of a standard offer for ULL and the early introduction of indirect access. In addition, the Italian NRA has focused on the introduction of a wholesale broadband product. (Source: OECD Report "Developments in Local Loop Unbundling", DSTI/ICCP/TISP(2002)5/FINAL, from September 10th 2003, pp. 22 and 45; ITU Regulatory Implications of Broadband Workshop - ITU New Initiatives Programme - May 2-4th 2001 "Italian Case Study", April 26th 2001, p. 15)

(5) The categorisation of France is due to the aim of the NRA to foster infrastructure competition, as well as the success of line sharing (Source: OECD Report "Developments in local loop unbundling", DSTI/ICCP/TISP(2002)5/FINAL, from September 10th 2003, pp. 39f; ERG "Broadband market competition report", ERG (05)23, May 25th 2005).

(6) The results for the UK are very significant, which may seem astonishing as the UK has fostered infrastructure competition in earlier years, thereby referring to the fact that the UK market was opened up with the duopoly policy as early as the 1980s. These results are based on the situation in the new millennium, indicating that UK regulatory policy has evolved from infrastructure-based to service-based competition.

Annex 2 – T-test

		Mean		Variance		P	Conclusions
		Infrastructure based	Service based	Infrastructure based	Service based		
Penetration rates	Penetration broadband	14,20%	8,10%	0,16%	0,08%	0,017	Significance
	Penetration DSL	10,40%	5,90%	0,02%	0,03%	0,003	Significance
	Fixed ISDN penetration 2004	14,20%	9,20%	0,40%	0,10%	0,154	
Prices 2004	National residential basket	28,36	31,21	17,96	15,96	0,283	
	National business basket	50,31	64,52	145,91	52,67	0,042	Significance
	Residential OECD composite basket	36,82	39,88	33,90	22,17	0,360	
	Business OECD composite basket	74,32	94,90	240,29	188,78	0,045	Significance
	Incumbent's basic monthly PSTN rental charge for business customers	11,88	18,27	4,42	2,32	0,000	Significance
	Incumbent's basic monthly PSTN rental charge for residential customers	13,49	17,79	5,92	6,81	0,022	Significance
Price changes between 2000 and 2004	National residential basket	6,10%	-6,60%	0,20%	0,90%	0,036	Significance
	National business basket	3,20%	-9,40%	0,40%	1,00%	0,049	Significance
	Residential OECD composite basket	-1,10%	-16,30%	0,50%	0,60%	0,009	Significance
	Business OECD composite basket	-3,80%	-11,90%	0,50%	1,80%	0,275	
	Incumbent's basic monthly PSTN rental charge for business customers	3,90%	27,40%	1,60%	4,10%	0,062	
	Incumbent's basic monthly PSTN rental charge for residential customers	8,80%	28,60%	2,00%	5,40%	0,146	
Prices 2005	Residential monthly rental	14,90	17,14	5,20	15,84	0,307	
	Business monthly rental	12,92	17,54	2,94	9,84	0,026	Significance
	Average monthly expenditure (composite basket), business	75,83	86,80	139,77	295,70	0,267	
	Average monthly expenditure (composite basket), residential	38,83	38,20	26,97	22,70	0,838	
Prices 2004 adjusted for PPP	National residential basket	26,75	32,02	28,31	44,26	0,192	
	National business basket	47,69	66,34	190,50	157,71	0,044	Significance
	Residential OECD composite basket	34,71	41,01	49,70	74,58	0,229	
	Business OECD composite basket	70,34	97,35	331,29	344,79	0,040	Significance
	Incumbent's basic monthly PSTN rental charge for business customers	11,27	18,61	8,11	3,75	0,001	Significance
	Incumbent's basic monthly PSTN rental charge for residential customers	12,76	18,06	9,95	5,58	0,011	Significance