DOI: 10.2478/v10051-011-0013-x

The Influence of Broadband Regulation in EU on the Development of the Regulated Technology

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The aim of the article is to answer the question if the level of intensity of "ex ante" regulation (also "regulation") imposed by NRA (national regulatory Authority or regulators) influence on the development of incumbent DSL technology against other Access technologies. There are several approaches which support the basic idea of regulation, that "ex ante" regulation promotes the competition. The approaches must be also based on the size of the market. In the internet world there are different access technologies. Open Access is crucial for the development of competition. Regulators have to ensure, that also new entrants can reach end users through the facilities of the incumbent operator. Based on the approach of three criteria, European Commission defines two wholesale relevant access markets both based on DSL technology ("bitstream" access and unbundled local loop) susceptible to sector specific "ex ante" regulation. In the last stage also optical access is included on the relevant markets. Other technologies are still not equivalent to incumbent DSL technology according to the opinion of the commission. The intensity of regulation influences on the competition conditions. It influences on the level where and at which point of the investment ladder entrants will enter the market through wholesale inputs or through building its own infrastructure.

Keywords: regulation, market analyses, broadband, correlation, DSL technology

1 Introduction

Among the different platforms for broadband access it is possible to distinguish between wired, wireless and fixed wireless (Picot and Wernick 2007, 660-661). Wired access platforms include digital subscriber line (DSL)/ copper line, fibre optics, powerline and cable. Wireless platforms comprise 3 G cellular and satellite transmission, while fixed wireless encompasses WiFi and WiMax. The distinction between different technology platforms is important for several reasons. First of all, in many countries distinguishes between technology platforms. Cable and DSL networks, as well as other broadband platforms show different technological properties. Designed for broadcasting, all participants in a coaxial cable share the bandwidth, which leads to variations in the capacity available to the user. Regulation of optical Access (also: next generation Access) will not be included in the analyses, because only a few regulators have started with "ex ante" regulation in the recent past and "there is perceived uncertainty about consumers' willingness to pay for next-generation Internet access services, which raises deep reservations about the viability of the business case for optical Access" (Siciliani, 2010). Since the liberalisation of the telecommunications sector, a debate exists on how to promote competition in the best interest of end users. The creation of good competitive conditions is seen as an efficient way to promote high penetration levels of communications services. "Regulating the incumbent's bottleneck by mandatory local loop unbundling and cost based open access provision has been the cornerstone of the regulatory framework in most European countries" (Bouckaert and van Dijk, 2010). In comparison to cable, DSL based on copper telephone lines offers steady bandwidth due to the fact that each participant has his or her own connecting line. Countries with both DSL and cable infrastructure benefit from infrastructure competition significantly. "There is an inverted u-relationship between cable market share and broadband penetration. The peak is at 50 % equal market shares of cable and DSL technology" (Höffler, 2005). For Broadband Internet connectivity there are two major networks: telephone and cable. There are also alternative technologies to Broadband Access, such as wireless, power line, satellite and UMTS. However, these technologies are still at the development stage, although in the future they might compete with cable and DSL. From this information it is possible to conclude that DSL is still the dominant technology, beside the next generation access via optical fibres. Regulators have to evaluate their decisions in the light of whether they promote the rolling out of parallel, competing infrastructure (infrastructure competition) or whether they further competition in a single network with regulated Access (intra-platform competition). Experiences from telecommunications deregulation and regulation show that up to now

Received: 11th January, 2011, received in revised from: 14th April, 2011, accepted: 14th May, 2011

regulators have tried to establish frameworks enabling both forms of competition. Nevertheless, especially in the US the positive aspects of service competition are put to the test (Picot and Wernick, 2007). In 2003 the obligation to provide shared DSL access to competitors were eliminated in the same way as non-discrimination obligations and obligations to offer DSL at wholesale in 2005 as the wholesale market for DSL and cable modem Internet access services were assessed effective and to remain so even in the absence of regulation. On the other hand, one should bear in mind that platform competition may also lead to negative results if gains from the reduced deadweight loss due to higher competition are outweighed by the inefficient duplication of an existing infrastructure (Laffont and Tirole, 2000). For example, in contrast to the European "ladder of investment", whereby new entrants would seek to progressively grow their business, in the USA, the only rung that solidly remains is the unbundling of cooper loops.

The new recommendation of the European (EC, 2007) on relevant markets defines Market 4 (previously Market 11) as the market for wholesale (physical) network infrastructure Access (also local loop unbundling) at fixed location and market 5 as Broadband Access (also bitstream). The both markets were recommended also via first European Commission recommendation in 2003. Those markets need to be analysed by national regulators to find out the existence of significant market power. There can be one or more operators with the significant market power. Most of the EU sector regulators (also: National Regulatory Agencies) have finished the first round of analyses and the results are shown on the market. The regulators ate now in the process to conclude the second round of analyses. The wholesale broadband access market comprises non-physical or virtual network access including "bit stream" access at fixed location. With bitstream access, the wholesale product of the incumbent DSL technology consists of transmission capacity, which allows new entrants to offer their own services to their customers. Bitstream access may also include "backhaul" services to carry traffic to higher layers in the DSL network, where the entrant already has a point of presence (Bouckaert and van Dijk, 2010). This market is situated downstream from the physical access covered by the wholesale unbundled access in that wholesale broadband access can be constructed using this inputs combined with other elements. Under the local loop unbundling lease, entrants have to invest in own equipment and facilities. Products or services included in both relevant markets are used as wholesale inputs to provide retail broadband access to end users at the retail level. This paper addresses the problem of using the different approaches of market regulation. Regulators imposed different remedies on both relevant markets bitstream and local loop unbundling. At the moment the only regulated technology in EU is DSL technology via bitstream or local loop unbundling inputs. Those wholesale inputs are regulated through various intensity of regulation in EU member states. Regulation should have a positive effect on the technology, which is regulated. Increased intensity of regulation should increase the market share of the regulated DSL technology of the incumbent. The mechanism of increased regulation forces the regulated incumbent to invest in other technologies based on the data from different markets. The intensive Local Loop unbundling regulation should be imposed after the results from the bitstream regulation have showed some positive results on the market development. According to the ladder of investment approach, the entrant is able to invest in its own network in the longer term and the experience from early entry at the retail level helps him in building up a competitive network. Paper describes in second section the different approaches in literature regarding different approaches in regulating the market. Especially it describes what are the advantages or disadvantages of different remedies imposed to SMP players. Different analyses have been done to find out the relationship between the level of competition on different levels of the incumbent network and the market development, but no analyses between the intensity of regulation on both Access markets and the parameters of market have been done since now. The third section explains the overall situation on the Broadband market and the practice in some of the most developed countries. Section 4 focuses on description and ranking of different possible remedies and explains the methodology used to answer the question, how the intensity of regulation influences the development of the regulated technology and how different chosen types of regulation influences on the behaviour of the incumbent and competition. The last two sections offered the proposed policy to regulators how to regulate both Access markets and on what kind of regulation should focus mostly, based on the results of the analyses. The proper regulation of Access market will still be the most important case in the process of Broadband development, also in period of co-existence of copper and fibre optics Access. The decision of which type of regulation should be chosen should also depends on the size of the country.

2 Literature review and theoretical framework

Regulatory policy gives rises to three modes of competition in broadband services, as presented in Table 1 (Bouckaert and van Dijk, 2010):

Table 1: type of competition modes

Competition mode	Type of the technology used by entrants
Inter-platform	DSL, cable and other technologies
Facilities-based/ intra-platform	DSL incumbent wholesale/ Unbundling of local loop
Service-based/ intra-platform	DSL incumbent retail/ Bitstream and resale

Without the mandatory access to the incumbent's DSL network, competition in broadband services takes the form in literature of inter-platform competition. Inter-platform competition refers to rivalry between the incumbent DSL operator and infrastructure-based operators on other platforms, most notably cable, but possibly also fibre-to-the home and wireless. When the regulator imposes access to the incum-

bent's network, competition takes the form of intra-platform competition. Intra-platform competition thus refers to rivalry between different DSL operators on the incumbent's network through regulated access. Mandatory access to DSL networks can take various forms, ranging from full local loop unbundling (ULL) to reselling the DSL incumbent's services.

Typically the SMP operator (operator with significant market power) is the national incumbent with the exception of the one NRA that defined sub-national geographic market identifying the corresponding local incumbents as having SMP (for example "Finland"). The EU framework of the European Parliament and of the Council recommends following remedies to be imposed on SMP players to prevent independent behaviour (EP, 2002): transparency, access obligation, accounting separation, non-discrimination, price control and cost accounting separation. The new framework issued in 2009 (EP, 2009) also includes the new remedy called functional separation. Among cost orientation two instruments of Access obligation are used: retail minus and cost-based. Cost based methods (ERG 2009) uses Historical cost Accounting (HCA) and Current Cost Accounting (CCA). Models like LRIC (long run incremental costs), LRAIC (Long run Average incremental costs) and FDC (Fully Distributed costs) are used. The most intensive regulation uses LRIC (LRAIC) as a method of regulation. The less intensive regulation uses FDC method based on current or historic costs. Non cost based regulation uses mostly retail minus (define the difference between the retail and wholesale price) for wholesale regulation. Models like benchmark and price cap are mostly used for retail regulation. Other remedies are non price control methods and are much weaker. Mostly just show the intention of regulation as a threat. Deregulation or no regulation is the level, where the NRA finds the market as fully competitive or regulation has not even started. Different remedies can be imposed to players with significant market power. "Retail minus regulation avoids foreclosure and leads to better results than cost-based regulation in terms of investment level and consumer surplus. Retail minus regulation allows a higher consumer surplus than deregulation of access price as long as the regulator carefully defines the retail minus instruments" (Brandão and Sarmento, 2007). The practice of the regulators in the definition of cost-based policy is to require that the entrants contribute to cover the fixed costs of providing access. Then, regulators define the mark-up to cover the fixed costs, or part of it. The concept of cost-based regulation adopted by many telecommunication regulators is the Long Run Incremental Costs (LRIC). The implementation of LRIC involves the quantification of the incremental cost of providing access in a forward-looking perspective. With this perspective it is necessary to consider the substitution costs of the assets that will be supported in the future. This is in contrast to historic cost accounting. Several problems can be indicated, when using LRIC model. "The precise quantification of LRIC raises many questions, namely concerning the allocation of common costs and the process of gathering the necessary information to compute appropriate replacement costs" (Mason and Valletti, 2001). The concept of LRIC mostly does not take into the consideration neither the irreversible nature of many telecommunications investments, nor costs with the development of new services that did not succeed in the market. LRIC model adopted by some European countries discourages investment in fixed networks by the incumbent firms, because they anticipate that they will be required to offer access at cost-based prices (Cave and Prosperetti, 2001). LRIC model also has a poor performance in terms of dynamic efficiency of cost-based regulation because firms do not have the incentive to innovate if they know that they will be required to offer access to their rivals at cost-based prices. If the regulator carefully defines the margin between retail and access (wholesale) prices, with retail minus regulation it is possible to achieve better results than either with deregulation or cost-based regulation, in terms of protection of downstream competition and consumer surplus. Retail minus regulation allows greater flexibility in access price definition than cost based regulation. Under the former, the access price definition is influenced not only by the costs but also by demand characteristics and oligopoly interactions that occurs in the retail market. The incumbent firm has a higher incentive to invest in network improvements, which has positive consequences on market development. Retail minus regulation does not require that the regulator has precise information about firm's costs. This is a very important feature for regulatory instruments considering the profound difficulties that the regulators may face in gathering information about the internal characteristics of firms, in particular in new markets where there is high uncertainty about costs. "Mandatory unbundling to incumbent operators can also delay facilities-based entry and reduce network investments, particularly if unbundled input prices are set too low. Excessive prices for essential network elements could hamper competitive entry." The results of statistical analysis show (Dippon and Ware 2010, 54-64) that when relevant demand and supply determinants are included in the analysis, the association between mandatory unbundling and increased penetration is not statistically significant. "The dynamic nature of the sector and the costs of implementing mandatory unbundling imply that policy makers should carefully examine the costs and benefits of regulatory intervention." The costs of mandatory unbundling is particularly complex because some of the costs are indirect- for example, reduced incentives to invest may stifle innovation and network development in ways that are not immediately apparent. It is also difficult to measure the impact of mandatory unbundling on investment and innovation because many factors, including change in other forms of regulation, mergers and acquisitions, and the state of the national economy, affects those activities, and only net affects are observable at the retail market. Policy makers must consider whether unbundling requirements could distort retail market competition because some platforms are regulated while others are not. The analysis of Dippon and Ware (2010) could also lead to wrong conclusion, while the parameter of mandatory unbundling is explained by percentage of MDFs (main distribution frames) with competitors present and not with the whole number of unbundled loops. The whole number could vary from the figures in the analyse, while there could a different number of unbundled loops at different MDFs. Almost it is impossible to come to the conclusion that regulation does not stimulate the growth. "The country- specific outcomes of liberalisation in Cyprus are consist-

ent with the general tendency in small European economies and jointly provide strong evidence that smallness affects the success of liberalisation" (Pavlos, 2009). The regression results show, that the effect of the number of operators on penetration rates appears to be statistically insignificant for internet services and the incumbent's market share remains unaffected by changes in the number of operators. For a large economy, intensive competition is very likely to both reduce market concentration and induce increase in service penetration. For a small economy, a loss in the incumbent's share will very probably impair its efficiency due to market size limitations, whilst expectations for a respective increase in service penetration must be reduced. Small economies maintain higher concentration levels after competition in all technologies. The Policy makers must take into the consideration also the each technology's life cycle in its policy formation. The closer to its saturation stage the technology is, the less likely its penetration rate will be influenced by competition. The success of liberalisation is not determined by the number of alternative operators and the decline in the incumbent's market share, but by the magnitude of increase in consumer welfare as this is depicted by service affordability, accessibility, quality, and innovation. Small economies can expect to achieve comparable outcomes to large economies by allowing only a few operators in their markets. The NRA needs to ensure that the incumbent will not abuse its dominant position while giving the incumbent operator sufficient incentives to increase its efficiency. The NRA may decline entry to candidate firms on efficiency grounds. Whilst discouraging entry might promote more concentrated markets, this should not necessary disadvantage consumer welfare. Intra-platform competition as measured by incumbent market share on the regulated DSL technology shows positive sign with penetration, but not statistically significant (Höffler, 2005). Thus, more intense competition in the retail market for DSL does not seem to significantly increase the broadband penetration. This sheds some doubt on the effectiveness of service or intra-platform competition. Based on the previous conclusions also smallness affects the concentration level and service or intra-platform competition, while on the other hand it is difficult to increase the infrastructure competition in a small market Additionally, population density for example has positive effects on penetration.

3 Existing situation on International Broadband market

In 2009 the EU broadband market continued to be the largest in the world, with some Member states leading in terms of penetration rates. The EU was catching up with the US in broadband take-up. The gap in penetration rates declined to 2.8 % percentage points in July 2009, from 3.4 points in July 2008. The penetration rate in US was 26, 7 % in July 2009, while the EU average was 24, 8 % (EC, 2010). Table 2 shows top 5 countries with the highest penetration rate in July 2009:

Table 2: Top 5 World Countries in Broadband penetration

Country	Penetration rate
Netherland	37, 9 %
Denmark	37,2 %
Norway	35 %
Switzerland	34 %
South Korea	33 %

Source: EU 15 Implementation Report

Most of the EU fixed broadband lines at the end of 2009 were based on copper DSL technology (79 %) and average speeds were usually lower than in other developed countries with high broadband penetration. Lines based on the fibre access only represented between 1, 8 and 5 % in EU countries, while this share was much higher in countries such as Japan (51, 4 %) or Korea (46 %). In the US, this share was 6 %. As of January 2010, 61 % of fixed broadband lines in the EU countries offered speeds between 2 and 10 Mbps. Low speed broadband lines with download rates between 144 kbps and 2 Mbps represented 15 % of all fixed broadband lines in January 2010, down from 25 % in 2009, while the fastest category of lines (10 Mbps and above) increased its share, from 14 % in January 2009 to 23 % of all fixed lines in January 2010. The speeds via optical fibres started mostly at 20 Mbps.

The penetration rates in EU increased from January 2004 till January 2010 from 4, 9 % to 24, 8 %. Overall growth has been slowing down over the past year and this is the evidence that the market is getting slowly mature. Local loop unbundling recorded positive growth and has become the main form of wholesale access for new entrant with 73.7 % of DSL lines in January 2010, up from 69,2 % in January 2009 (EC, 2010). New entrants, use of bitstream access for local loop unbundling in the provision of broadband services remain stable (15, 9 %). The share of lines based on resale, which represents a type of access for low-investment intensive new entrant, had shrunk by 3, 5 % percentage during the year of 2009. Its market share was 9, 4 % at the end of 2009. At the end of 2009 only 1 % of lines were realised by the own network of the new entrants. Countries like Bulgaria, Romania, Checz Republic with the penetration rate below the EU average have very low percentage of DSL technology. Competition is based on cable modem networks, local new networks and fixed wireless access. The similar situation is in small countries like Latvia, Lithuania, Estonia, Slovakia and Malta, where the incumbent operator fully or almost fully, controls the DSL market. With the Exception of Slovakia, in none of these countries is DSL predominant technology. Also the intensity of regulation is weak in all of those countries. Penetration rate is quite low in bigger countries with low intensity of regulation. Based on the study on OECD countries by Bouckaert and van Dijk (2010) only inter-platform competition has a significant, positive effect on broadband penetration. From this point of view regulation needs to encourage infrastructure competition, which is not really the case at the moment in EU. On the other

side it is necessary to take into the consideration different size of EU member states by adopting the appropriate regulatory measures. The intensity of regulation did not resultin significant decreases of local unbundling prices in 2009. On average, prices for fully unbundled lines only decreased by 1 %, while prices for shared access declined by 5,1 %. These reductions are similar to the 2007 levels. So we can assume that also the intensity of regulation was quite stable during the period. The penetration level in EU is the highest in Netherland and Denmark. Regulation in Netherland is cost based, but not based on LRIC model. That means that regulator uses the costs of existing network and not the optimal one on both access relevant markets. In Denmark the regulation is based on LRIC model on both markets. Regulation is also very strong in Switzerland on both markets, while in Norway the regulation is based mostly on local loop unbundling. South Korea as the fifth country regarding top level of world penetration focuses mostly on sector regulation and not "ex ante" regulation. State of South Korea supported dialog between main players on market, Access providers, equipment providers and content providers. High level of penetration is also the result of the high level of infrastructure competition (Bae, Jeon and Kim, 2008). The government of South Korea also encourages the demand by recommendations regarding the price policy. South Korea is a big country with high demand and probably this practice should be taken with care in smaller countries.

4 Research method

The basic researsch method used is survey of obligations imposed to incumbent operater on two relevant Access markets recommended by the European Commission. »Ex ante« regulation in EU is based on service and facility regulation. Service regulation is ensured by imposed obligations on bitstrem market, while facility based regulation is ensured by imposed obligations on local loop relevant market. The set of imposed obligations are published in ERG Report (ERG, 2009). The sample is 27 EU countries, Switzerland and Norway, which implemented the Electronic Communications Law based on EU Directives. It is important to emphasise that first EU recommendation regarding the relevant markets was published in 2003. Since then regulators in EU countries have started analyses based on relevant markets. They have imposed different obligations to incumbent operator, which is mostly the only one who is the subject of »ex ante« Access markets regulation. In the last years regulators started to impose different level of the regulation intensity to incumbent operator. The list of imposed remedies is in Table 1. There are five different levels of ranking. If some regulator did not complete the analyses or did not impose any obligation to the incumbent then its ranking is 1. If the regulator did not impose any of the price control remedies then its ranking is 2. The possible non price controls are transparency, non-discrimination and access obligation. Those remedies allow a lot of freedom to incumbent regarding setting its wholesale prices. Obligation of retail minus only imposes the difference between retail and wholesale price to the incumbent operator. So it allows still some freedom to the incumbent regarding setting its wholesale prices. The last and most intensive regulation is cost based regulation. It is divided in two groups, one for cost based regulation which is based on the actual network of the incumbent and the most intensive regulation which is based on the optimal network, built now and with current prices. The most intensive regulation is definitely based on imposed LRIC model, which is quite a common practice in EU, despite the fact that networks were built in the past. Summarized ranking is presented in Table 3:

Table 3: Ranking of remedies

Remedy	**Rank**
No regulation	1
Remedies except cost price control	2
Price control with the retail minus remedy	3
Cost based prices (FDC …) except LRIC model	4
LRIC, LRAIC model	5

Both markets defined for the purpose of wholesale Access Broadband regulation should be analysed together, but different remedies were imposed to each of them. So the main question is how the increasing intensity of regulation from 1 to 5 influences the share of DSL technology in different member states and also the intra and inter-platform competition in EU. To answer this question we will use the correlation matrix and linear regression model. We will compare the data of intensity of regulation on both Access markets, market share of DSL technology, incumbent share on retail broadband market, incumbent share on DSL technology and the level of penetration.

5 Results

The Pearson's correlation coefficient between the two variables is defined as (Nicewander and Rodgers, 1988):

$$r_{yx} = \frac{c_{yx}}{s_y * s_x} \text{ and } -1 \le r_{yx} \le 1 \quad (1)$$

Where c is koeficient of co-variance and s is standard deviation koeficient. We insert data (Appendix 1) with normal distribution from EC Reports (2010) and from ERG Reports (2009) into the model SPSS15 for windows and come to the results in Table 4.

From the matrix we can predict that intensity of regulation on both markets has positive effect on the development of DSL technology, but not statistically significant with high risk of acceptance. The correlation is not statistically significant. The correlation between the market share of incumbent on the retail level and the share of DSL technology is slightly negative, but also not statistical significant. The correlation is statistical significant and positive between market share of incumbent on the retail market and the intensity of bitstream regulation. So there is evidence that intensive bitstream regulation force incumbent to invest in other technologies (not just DSL) and try to improve its market share on the retail level.

Table 4: Results from SPSS15 (correlation matrix)

X/Y	Regulation (bitstream)	Regulation (local loop)	Share of DSL tech.	Share of incumbent on DSL	Share of Incumbent (retail)	Broadband penetration
Regulation (bitstream) Pearson Correlation (r) Sig. (2-tailed) N	1	,635** ,000 29	,056 ,789 27	-,463* ,015 27	,433* ,024 27	,561* ,002 29
Regulation (local loop) Pearson Correlation (r) Sig. (2-tailed) N	,635** ,000 29	1	,216 ,279 27	-,404* ,036 27	,116 ,563 27	,429* ,020 29
Share of DSL technology Pearson Correlation (r) Sig. (2-tailed) N	,056 ,789 27	,216 ,279 27	1	-,075 ,709 27	,118 ,557 27	-,182 ,363 27
Share of incumbent on DSL (retail) Pearson Correlation (r) Sig. (2-tailed) N	-,463* ,015 27	,404* ,036 27	-,075 ,709 27	1	-,347 ,076 27	-,434* ,024 27
Share of incumbent (retail) Pearson Correlation (r) Sig. (2-tailed) N	,433* ,024 27	,116 ,563 27	,118 ,557 27	-,347 ,076 27	1	,337 ,086 27
Penetration Pearson Correlation (r) Sig. (2-tailed) N	,561* ,002 29	,561* ,002 29	,561* ,002 29	,561* ,002 29	,337 ,086 27	1

** Correlation is stastical significant*
*** Correlation is statistical significant (high level of correlation)*

The impact of the intensity of regulation on both markets has negative influence on the market share of incumbent on the DSL technology. "The intensive regulation increases the service competition and service competition also increases penetration" (Höffler, 2005). The correlation matrix also in our case shows us a significant negative statistical correlation between the incumbent share on the regulated DSL technology and level of penetration. This correlation proves that service competition or intra-platform is also important, because it has definitely positive influence on market development. The correlation matrix shows us, that intensive bistream regulation has stronger influence on the level of penetration than local loop unbundling regulation. Despite the fact that EU market in some countries is close to saturation, bitstream regulation is also important. Especially in small countries and countries with lower penetration, intensive bitstrem regulation should be the main key driver of competitive environment.

Additionally we can evaluate the linear regression model (method ENTER) between two types of regulation, which are strongly correlated. It is expressed by Pearson's correlation coefficient r=0, 635. The average regulation based on local loop unbundling is stronger and it counts on the level of 3,45, while the level of bitstream regulation is 2,72. Also the standard deviation in case of local loop unbundling is higher. The regression model between the two types shows following results:

The regression model is constructed in such a manner that we can explain 38 % of local loop unbundling regulation intensity by the intensity of bitstream regulation. Table 5 contains the regression coefficients b_0 = 1,501 and b_1 = 0,715 If the intensity of bitstream regulation is increased by 1, the intensity of local loop unbundling is also increased by 0, 715. If there is no bitstream regulation (rank=1) the intensity of local loop unbundling regulation is 2,215. The correlation between the variables is progressive. So the regulation is either strong on both segment or weak on both segments. We can assume that principle of the ladder of investment regulation is not completely fulfilled or the observed EU countries are not at the stage where the regulation started to go down the ladder

Table 5: Regression ENTER model

Model	Unstandardized Beta	Std. Error	Standardized Beta	T	α
Constant	1,501	,506		2,964	,006
Intensity of regulation (bitstream)	,715	,168	,635	4,266	,000

Dependent variable: Intensity of regulation (local loop unbundling)

even the fact that market is somewhere close to saturation and only higher access speeds will be offered in the future.

6 Discussion of research results

The model shows no statistical evidence that intensity of regulation influence the development of DSL technology. Anyway there is slight evidence, that regulation improves the benefits of regulated technology. We can see from the correlation matrix that correlation between regulation of bitstream and local loop unbundling is strongly correlated and positive. So at the moment it is no evidence of complete validation of the ladder of investment regulation in EU, despite the fact that regulation on local loop unbundling is more intensive than bitstream regulation. The correlation between level of regulation on two markets should be statistical significant, but probably negative to confirm the validation of the ladder of investments regulation. The results also show that incumbent tries to invest in new networks based on strong wholesale bitstream regulation. Strong local loop regulation does not force the incumbent to invest in other broadband technologies or at least the correlation is not statistically significant. The bitstream regulation forces the incumbent to improve its retail market position by investing in other technologies. It has definitely stronger influence on the market development than local loop unbundling regulation. This statement is also confirmed by the fact that local loop regulation is more intensive at the average, but has less influence on market characteristics. It has less influence on the level of competition and also on the market share of the incumbent on retail market. The intensity of local loop unbundling regulation has more influence only on the development of DSL technology compared to others Access technologies. It improves the value of DSL technology more than bitstream regulation. More the intensity of regulation goes down the ladder of investment highest is the market share of DSL technology. Anyway Broadband regulation should be based mostly on bitstream regulation, which is strongly recommended for small countries, where the concentration is very high and carries are not highly interested to invest in its own Access network. Regulators should basically focus on local loop unbundling regulation after the precise market analyse and the fact, that the results from bitstream regulation are proven on the market outcomes. Regulation must have positive effect on infrastructure competition in dependence from size of the economy. The results of this analyse proves that with the increasing intensity of regulation incumbent market share started to decline on the regulated technology and increase on other non regulated technologies. The intensity of regulation has a positive effect on the development of the regulated technology, despite the fact that the statistical correlation is not significant. Increased intensity of regulation increases intra-platform competition and also forces the incumbent to be more active in infrastructure or inter-platform competition on the market. On the other side the level of intra-platform competition measured by incumbent market share on the regulated technology has positive effect on penetration level. Bitstream regulation has stronger effect on the penetration level than local loop unbundling.

7 Conclusion

This study explores the influence of different levels of intensity of regulation on the development of regulated technology and the behaviour of the regulated operator or operator with significant market power. Based on the results from this study it is obvious, that at the moment bitstream regulation which promotes service competition is less important in Europe than local loop unbundling regulation which promotes facility based competition. In both cases new operators are using incumbent's network, where the entrant is able to invest in its own network in the longer term and the experience from early entry at the retail level helps him in building up a competitive network. Regulators should promote inter-platform competition through the process of mandatory access from service to facility based competition. Bitstream regulation forces incumbent to invest in other non-regulated technologies and from this point of view has positive effect on investments. Strong bitstream regulation has a strong negative influence on incumbent's market share on the regulated technology. While entrants entering the retail market through resale, bitstream or local loop unbundling are offering on the retail market DSL servicer, we can conclude that bitstream regulation is more effective than local loop unbundling in EU countries. Despite the fact that most of the non EU countries promotes only local loop unbundling it is crucial to define the point where it is necessary to phase out bitstream regulation. Regulation must follow the investment ladder and allow new entrant firstly to get bitstream product by intensive service regulation, later on to start with intensive regulation on local loop unbundling and finally to promote inter-platform competition. European Market is at the stage, when regulators should focus and increase the intensity of regulation of Bitstream products,

especially in smaller economies and countries below the average penetration level. At the later stage of market development, it is also crucial to define the limits between regulation and deregulation. It is important to define the point when the intra-platform and infrastructure competition on the vertically correlated retail market are high enough to prevent independent behaviour on the wholesale level, taking into the consideration also the level of market saturation. This should be the basis for further researches.

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Appendix 1

	Country	Intensity/LLU	Intensity/BS	DSL Share	Incumbent DSL share	Incumbent retail share	Penetration level
1	Austria	5	3	0,68	0,75	0,51	22,7
2	Belgium	5	5	0,57	0,86	0,49	29,1
3	Czech Republic	1*	1	0,39	0,87	0,34	19,1
4	Denmark	5	5	0,6	0,73	0,63	37,8
5	Estonia	4	3	0,42	0,94	0,52	26
6	France	4	4	0,95	0,48	0,46	30,3
7	Germany	2	2	0,9	0,51	0,46	30,4
8	Greece	5	3	100	0,56	0,55	17
9	Hungary	5	2	0,44	0,77	0,41	18,7
10	Ireland	5	3	0,72	0,69	0,51	22,2
11	Italy	4	4	0,97	0,59	0,57	20,6
12	Lithuania	4	1	0,36	0,99	0,49	18,9
13	Netherlands	4	4	0,62	0,74	0,48	37,7
14	Norway	4	2				35
15	Poland	1	1	0,56	0,72	0,4	13,5
16	Portugal	3	4	0,59	0,73	0,44	18,6
17	Romania	3	1	0,28	100	0,28	13
18	Slovak Republic	1	1	0,46	0,92	0,44	14,8
19	Slovenia	5	4	0,62	0,66	0,46	22,9
20	Spain	3	4	0,8	0,68	0,55	21,5
21	Sweden	5	3	0,59	0,61	0,39	31,5
22	Switzerland	5	5				34
23	UK	5	2	0,79	0,36	0,28	29,8
24	Finland	3	2	0,76	0,68	0,67	29,4
25	Luksemburg	2	3	0,83	0,8	0,67	32,1
26	Malta	2	2	0,48	0,94	0,45	26,8
27	Cyprus	3	3	0,94	0,83	0,78	22,2
28	Bulgaria	1	1	0,31	100	0,31	13
29	Latvia	1	1	0,49	100	0,52	19,3

Source : EC Reports and ERG 2009
**Regulators did not finish the first round of analyses regarding those two markets till 2009 or did not impose any obligations to SMP player*

Vpliv regulacije širokopasovnega dostopa v Evropski skupnosti na razvoj regulirane tehnologije

Namen članka je odgovoriti na vprašanje ali nivo intenzivnosti regulacije vpliva pozitivno ali negativno na razvoj regulirane tehnologije. Obstaja veliko različnih pristopov regulacije, ki podpirajo osnovno idejo, da predhodna regulacija pospešuje konkurenčnost na trgu. Način regulacije mora biti odvisen tudi od velikosti posameznega nacionalnega trga. Pri ponudbi širokopasovnega dostopa obstaja veliko dostopovnih tehnologij. Odprt dostop za vse operaterje je ključ za razvoj konkurence. Regulatorji morajo zagotoviti, da imajo tudi novi vstopniki na trg, možnost ponudbe storitev končnim naročnikom preko dostopovnih kapacitet vodilnega operaterja (Telekoma). Na podlagi metode treh kriterijev je evropska komisija za potrebe predhodne regulacije priporočila oz. definirala na DSL tehnologiji Telekomov dva medoperaterska relevantna trga in sicer dostop preko bitnega toka in razvezavo lokalne zanke. V sklopu zadnjega priporočila je vključila tudi storitev optičnega dostopa na oba relevantna trga. Ostale tehnologije ne ponujajo enakih funkcionalnosti in zato evropska komisija ne priporoča predhodne regulacije. Intenzivnost regulacije, ki se izvaja na posameznih relevantnih trgih vpliva na konkurenčne razmere. Vpliva tudi na odločitev operaterjev, na katerem nivoju lestvice investicij bodo vstopili na trg ali preko uporabe medoperaterskih storitev ali pa preko izgradnje lastne infrastrukture.

Ključne besede: regulacija, tržne analize, širokopasovni dostop, korelacije, DSL tehnologija