Unbundling Policy in Telecommunications: A Survey

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1. Introduction

The policy of unbundling, at the same time, implies the obligation of the incumbent 1) to negotiate specific network elements or in combinations with the entrant and 2) not to "bundle" these elements for wholesale without acceptance of the entrant. This is a sort of *per se* prohibition of a "tie-in-wholesale" in the telecom market.

The purpose of the obligation to unbundle network elements is to avoid a deliberate strategy of the incumbent in raising entrant's costs by including costly, but useless or dispensable network elements, in the wholesale transaction with the entrant, "squeezing" the latter[2]. Unbundling would also avoid a possible extension of market power from one monopolistic network element (e.g. the local loop) to other potentially competitive element.

The main purpose of unbundling is to enhance competition in the sector by making feasible to the entrant a "phasing-in" process of entry, first choosing which network elements he will provide by himself and which he will buy from the incumbent. The entrant becomes able to enjoy the scale economies of the incumbent, overcoming the most important barrier to entry in the sector by having access to network elements whose duplication is economically unfeasible. Unbundling is part of the more general set of "open access policies", for which interconnection is the most important one[3]. And open access policies have, as pointed by Sidak and Spulber (1997, p.48), "*their counterpart in antitrust law in the form of essential facilities doctrine*", which comprehends an even larger set of sectors and cases[4]. Moreover, the unbundling policy permits that entrants engage in a "learning by doing"[5] process, which helps future facility-based entry and reduces their demand uncertainty.

As pointed by Braunstein (2003) and Beard, Kaserman and Mayo (1998,p.317), unbundling is not a completely new policy in telecommunications. In the US, in the 70's

[2] See Nalebuff (2004) for the theory of bundling as an entry deterrence strategy.
[3] Noam (2001,p. 169)considers the demand of MCI of interconnection at several intermediate points of AT&T´s network as an early attempt to have "*AT&T´s network unbundled*". The author (p. 174/184) presents a history of the policies on the Open Network Architecture –ONA- in the US, which he considers as "*the precursor of the physical unbundling that followed it*".
[4] The first antitrust case where the "essential facility" doctrine was applied was in US v. Terminal Railroad Association. A bridge over a river was considered as an "essential facility" and an order to open its access to third parties was implemented by the Supreme Court. For more details on this doctrine, see Motta (2004, p. 66/68).

and 80's, the then small entrants, MCI and Sprint, besides interconnecting to the AT&T's local loops, also leased long distance access from the latter to supplement their own infrastructure or even resell AT&T services. Sprint took about 10 years to fully develop its own long distance infrastructure.

There is a reasonable consensus that an unbundled based entry is not so vigorous for the sake of promoting competition compared to a facility based entry, when the entrant builds its own network. This is because 1) entrants become more dependent on the incumbent, turning them naturally more friendly and less aggressive in competition; 2) the scope for service differentiation is naturally reduced when the entrant is restricted in his capacity to change the infrastructure design at will, a feature that becomes stronger, the more comprehensive is the set of unbundled network elements requested; 3) facility-based entry signals a credible commitment that the entrant will stay on the market.

That is why regulators use to consider unbundled based entry as a step to ease facility-based entry in the future. On the other hand, even this long run target may be flawed as long as the duplication of the infrastructure is considered wasteful and then unbundled entry should be taken as a long run target *per se* and not as a step for a (undesired) facility-based entry. Wasteful duplication, however, does not comprise all elements of the infrastructure, but mainly those that are actually uneconomical to replicate, one of the necessary conditions for the definition of an "essential facility". This is why Harris and Kraft (1997) already advocated that unbundling policies should be constrained to the network elements characterized as "essential facilities", a policy explicitly implemented in 1997 in Canada, where local switching was not considered for unbundling. Under this rationale, the "local loop", which is the metallic copper wire that links the customer premises to the central switching office, would be the infrastructure element *par excellence* to focus the unbundling policy.

There are two main problems with the characterization of unbundling, First, as stressed by Sidak and Spulber (1997, p.52), *"the regulatory definitions of individual services and network "components" are necessarily arbitrary, for any service is a bundle of features*". Second, how to draw the line, in practice, between monopolistic and

[5] See Bourreau and Dogan (2004, p.304).

potentially competitive elements. According to Noam (2001, p.173), we never know whether an element is potentially competitive since "*it was never available apart from a monopolist element*". Moreover, this line may be changing continuously, which makes the regulatory task harder.

Unbundling policies started aiming to promote competition in voice telephony, especially when considering its regulatory appearance in the US, in the Telecom Act of 1996[6]. The set of network elements eligible for unbundling was quite comprehensive. But most countries focus the most difficult network element to replicate and which is considered a classical example of an essential facility: the local loop.

The rationale for unbundling has evolved since then with a growing interest on fostering broadband competition and, thus, penetration through xDSL technologies. Since the voice service uses only a relatively small part of the useable spectrum of a metallic pair (3,1 kHz) of several MHz, the rest of the spectrum remained unused. With the development of xDSL technologies, this remaining part of the spectrum started to be used to provide a variety of broadband services. This allowed a combination of low-speed and high-speed services to be provided on a single line at the same time. Furthermore, this also turned feasible commercial arrangements where different companies run different or concurrent services on the same copper pair. More precisely, it became feasible the entrant's access to unbundled lines with the specific purpose of exploring the most promising broadband segment, while maintaining the voice service with the incumbent.

Although the broadband market is disputed everywhere not only by telephone operators with xDSL technologies, but also by cable companies, the requirement of unbundling only falls in the former. This is often considered as an inadequate regulatory asymmetry between these players, inducing artificially for more investments in broadband from cable platforms compared to telephone ones. In the US, as shown by Crandall (2005, p.184), the extension of the unbundling policy to cable companies went to the courts where it was refused.

[6] As stated by Crandall (2005, p. 177), contrarily to the common sense, it was not the US the first country to adopt unbundling. Hong Kong had implemented that in 1985.

Besides this introduction, this article presents the (not mutually excludent) types of unbundling in section II and what is the scope of competition in each one of them. In section III, we discuss the relationship between this policy, investment and pricing. Technical problems in implementation are commented in section IV and section V summarizes the international experience in unbundling. Section VI concludes.

2. Types of Unbundling and the "Value of Competition"

Broadly speaking, we can distinguish eight modalities of "unbundling".

1) Unbundled Network Element - Platform (UNE-P): The entrant requests, in an unbundled way, local loops, switching and transport facilities, among other network elements, "rebundling" them afterwards. This is, in practice, a resale modality, since the entrant almost does not add any value to the service, which raises a lot of critiques about the value of this kind of competition in the market[7]. The difference is that with UNE-P, entrants may package its services differently from the incumbent[8].

2) Unbundled Network Element – Loop (UNE-L): The entrant leases the local loop and, perhaps, some transport capacity from the incumbent, but connect the former to its own switching. UNE-P and UNE-L are used in the US, but not in Europe. As the entrant operates at least his own switching, the capacity to differentiate the service is enhanced, which turns it a more valuable kind of competition compared to UNE-P.

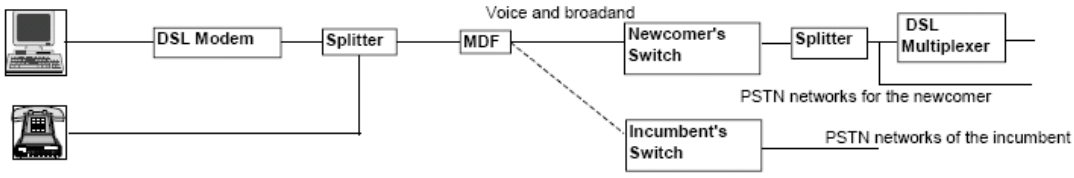
3) Full Local Loop Unbundling (Full LLU): This can be taken as one particular case of UNE-L, where the entrant leases only the local loop. Given that the entrant adds all network elements, but the local loop, this particular modality of UNE-L is where the value added to competition is the greatest. The wire stemming from the Main Distribution Frame (MDF) is simply disconnected from the incumbent's switch and re-connected into the

[7] That is why Kahn (2004, p.31) points out that "*my first objection to the UNE-P was aesthetic: "unbundled network elements" combined into a single bundle in an oxymoron*". These critiques made the US start a process of phasing-out of this kind of unbundling as we will see below.

[8] Nuechterlein and Weiser (2005, 96) exemplifies this difference: "*Rather than reselling the exact services offered by the incumbent, a UNE-P competitor can use the network capacity it has leased to sell its customers, say, a $ 50 per month bucket of unlimited local and long distance minutes whether or not the incumbent does so.*" Of course, the capacity to package differently depends crucially on the way UNE-P pricing is regulated. Several authors stress this odd regulatory imbalance. Woods, Zarakas and Sappington (2004, p.3), for instance, state that the regulated charges difference between resale and UNE-P is, in average, 20% throughout the US.

entrant's switch, which is a process called "hot-cut" or "cutover" as shown in the figure below taken from the OCDE (2003).

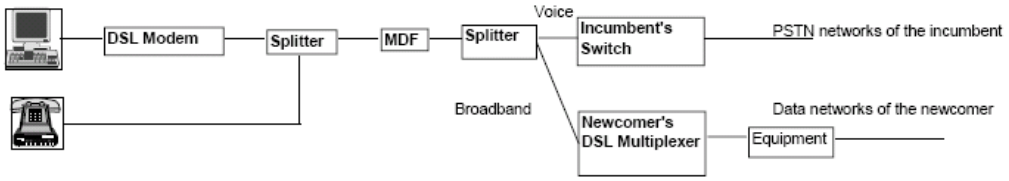
Figure 1. Full unbundling



As in UNE-P and UNE-L, the entrant can use the local loop to provide both, voice and broadband services, including the choice of the xDSL technology[9].

4) Line-Sharing: The metallic line spectrum is split (or shared) so that the incumbent remains supplying voice services over the line, while the entrant uses the remaining spectrum to provide high-speed data services through the use of its own xDSL technology. In line sharing, a splitter is installed after the MDF to divide the two bands of the spectrum. The narrowband related to the voice service is directed to the incumbent switch, while the broadband related to the xDSL services is directed to the entrant's DSL multiplexer and then to its data networks as in the figure below taken from the OCDE (2003):

Figure 2. Line sharing



In this modality, the entrant may or may not provide voice service, depending on whether he uses VOIP or not. If he does not, he does not provide competition in the voice service, where market power is more pervasive, the whole "value of competition" is lower

[9] However, as stressed by Gabelmann (2001,p. 737) even this modality has some constraints on entrant´s flexibility since "*not all lines are qualified for all types of xDSL*".

than in the case of Full LLU. Furthermore, Gabelmann (2001, p.737) states that broadband service differentiation is more limited under line-sharing, since some technologies as Symmetric DSL (SDSL), high speed DSL (HDSL) and very high bitrate ADSL (VDSL) cannot be employed because require the full frequency of the local loop spectrum. This limits the "value of competition" through this modality compared to Full LLU, even if we consider just the broadband market.

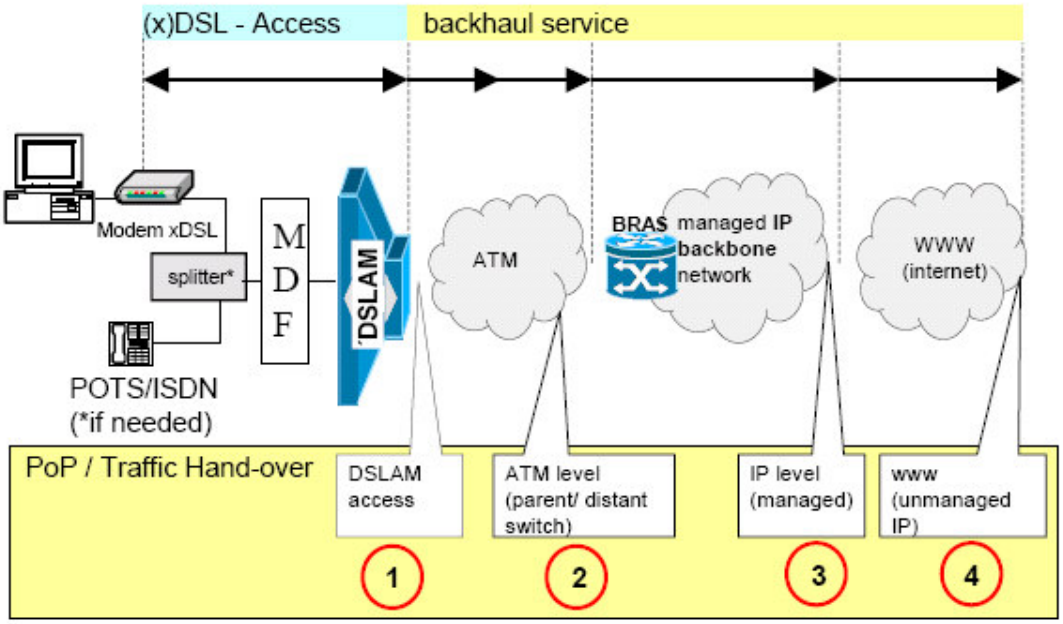
In line-sharing, "marketing scope economies" and incentives for innovations improving physical scope economies between voice and broadband services may be lost as pointed by Jorde, Sidak and Teece (2000, p.26/27)[10].

5) Sub-Loop unbundling: This is a much more far-reaching and complicated regulatory measure than Full LLU, since the entrant gains access between the MDF and the customer premises and not after the MDF like in other LLU modalities. This arrangement is often used to supply very high bandwidth services that can only be transmitted at a short distance on copper pairs, not rarely complemented with fibre deployment by the entrant.

6) Bit-Stream[11]: In this modality, the incumbent does not release all remaining spectrum to the entrant, remaining able to provide himself, beyond the voice service, his own xDSL service to customers. The capacity of the entrant to differentiate his xDSL service is more limited than in line-sharing and Full LLU, since the incumbent keeps control of most of the operational aspects of the service, through the control of the Digital Subscriber Line Access Multiplexer -DSLAM-[12] as in the following figure below taken from Cave (2004, p.37).

[10] The authors argue that the incumbent would lose the opportunity to offer, for example, one single flat-rate for voice and DSL.
[11] Bit-stream is not technically considered unbundling, but in this text we will not make that distinction.
[12] A DSLAM has the function to separate the voice-frequency signals from the high-speed data traffic and controls and routes digital subscriber line (xDSL) traffic between the subscriber's end-user equipment (router, modem, or network interface card [NIC]) and the network service provider's network. In some sense, the DSLAM is a more sophisticated splitter, since it performs more functions.

Figure 3 - Bit-stream



The "value of entrant competition" in bit-stream to consumers is smaller than in Full LLU and line-sharing. However, there are also three sub-modalities of bit-stream (points 1 to 3 in the figure), defined according to the point of connection of the entrant after the DSLAM plus the (fourth) alternative of simple broadband resale (point 4). According to the EC (2004), the definition of bit-stream "*leaves open at which point the traffic is handed-over as there are various hand-over points for DSL traffic between the incumbent and the other licensed operator/internet service provider. The point of access (point of handover of traffic) determines both the possibility to control the technical parameters with which the xDSL service is provided to the end user and the possibility to use the own network instead of the incumbent's…… the possibility to differentiate the service offered to the end user (and thus the extent to which value can be added by the new entrant) declines from Option 1 to 4, in other words: the further to the right the access point is, the less possibilities the new entrant has to differentiate the service*"[13].

[13] A detailed description of the options and its implications for the degree of freedom to differentiate and then to compete is presented by the EC (2004).

Actually, as pointed by Cawley (2004), "*since the structure of existing networks vary considerably between existing countries and continues to change*", the potential number of points of access for bit-stream may be even greater than those depicted in the figure. According to Cave (2004), this introduces "*some ambiguity or elasticity into the definition of bit-stream*". This complicates a lot the task of bit-stream regulation, mainly if considering that the relative prices of bit-stream at different points of access may be consistent among each other.

7) Broadband Resale: It is Option 4 in Figure 4. The incumbent provides the DSL access link plus a backhaul service and also the connectivity to the public Internet Protocol (IP) network. At this level, the product the incumbent sells to the new entrant is technically the same he sells to his own customers. The only thing the entrant has to do is to market (brand), distribute and bill the product, with almost no room for differentiation.

8) Resale: The entrant can also resale the whole service of the incumbent, including voice and broadband. The incumbent controls fully the operation of the entrant.

Beard, Kaserman and Mayo (1998) summarize the critique about the lack of value of competition from items (1), (6) and (7): "*This argument views resellers as nothing more than impotent distributors of existing Incumbent Local Exchange Carriers (ILEC) services, providing precisely the same retail-stage functions in precisely the same ways and at the same costs. As a result, customers shifting from the ILEC to the entrant receive no net benefits in terms of lower prices or improved services. The competitive process is seen as a zero-sum game-whatever one party gains, another party loses*".

Even not being able to differentiate services, it is commonly argued that resellers can make lower prices closer to the competitive level. However, to be able to charge a competitive price, resale pricing may be also closer to wholesale competitive prices, which requires price regulation. But in this case, what is the difference for the regulator between regulating the wholesale price for resellers or the retail price of the incumbent to customers? The lack of bargaining power of the buyer and the regulatory information asymmetry behind those two forms of price regulation are basically the same. So, their value added to customers welfare is unclear.

The value of resale competition or, more generally, the value of competition in one stage of the productive and distributive chain depends crucially on the existence of competition in the other stages of the chain. Following Kaserman and Ulrich (2002, p.417), and assuming a fixed proportions technology, as long as one of the stages remain monopolist, the price the consumer will pay at the last stage will be the monopoly one[14], or even higher, in view of the double marginalization[15] effect when there are also market power in other stages of the chain. This makes the benefits of competition complementary in all stages of the chain and, thus, the benefits of resale (downstream) and facility (upstream) based entry also complements, a hypothesis successful tested by the authors (p. 421/ 422) for the long distance service.

This means that fostering resale or any kind of unbundling competition is completely useless for the sake of reducing prices compared to the case where the incumbent is fully vertically integrated[16]. So, the value of downstream competition in telecommunications is restricted to downstream differentiation, be it improving quality or reducing retail costs and thus prices.

On the other hand, Beard, Kaserman and Mayo (1998, p.317) defend the value of resale competition since: 1) consumers start to experience a choice between carriers[17]; 2) there are possibilities of aggregating value to the sale stage of the service provision. Under appropriate price regulation, only entrants who perform the retail function at costs that are equal or below those of the ILECs or at service quality in the form of innovative product offerings and improved marketing strategies that match or outperform the incumbent, are able to enter; 3) resale entry is a step to facility-based entry because it reduces the barrier to entry represented by the existence of sunk costs coupled with business uncertainty. According to the authors "*development of a customer base and brand recognition through successful resale entry can provide the antidote to the entry-suppressing effects of the large sunk costs associated to facilities construction.....resale entry evolves naturally into*

[14] Assuming that retail costs do not change.
[15] See Tirole (1988, p. 174/175) and Motta (2004, p..307/313).
[16] Only in the case when the incumbent is not integrated downstream in resale and the current resellers have some jointly market power is that more resale competition will decrease prices. In this double marginalization scenario, however, if the resale margin is really inefficient, the incumbent has the incentive to integrate downwards and correct the problem.
[17] It is not clear why adding a choice over the same thing improves consumer welfare.

facilities-based entry and the provision of wholesale services in conjunction with unbundled network element promotes that evolution." Initial commercial activities of resale would thus constitute a "pre-commitment" of purchase from consumers that reduce the likelihood of a potential failure on attracting customers. Thus, sunk costs would be the key to connect resale competition in the present to facility based competition in the future, representing an intertemporal complementarity of these two types of entry[18].

Furthermore, the authors (p. 321) point out that "non-trivial" economies of scope between the network stage and the retail stage may be lost in resale arrangements.

3. Unbundling, Investment and Regulated Pricing

There is an endless discussion among incumbents and entrants about the suitability of regulated wholesale prices. As expected, whatever regulated prices are, entrants claim they are quite high for their appropriate survival and growth in the market, and incumbents claim they are quite low for the sake of recouping their investment[19]. Defendants of the incumbent´s view as Sidak and Spulber (1997, p.54) argue that low regulated rates are pervasive and "*represents a breach of the regulatory contract*". In the specific case of Ireland in 2001, for instance, the regulator defined interim regulated rental charges based on the simple mean of ten European countries. Sidak and Singer (2002) show the distortions caused by this approach in view of the different population densities and network architecture throughout the country. According to the authors (p. 289), regulated monthly rental rates should have been 42% higher if the regulator incorporated some relevant variables to calculate interim prices.

Sidak and Spulber (1997) and Epstein (2004) assess unbundling from the perspective of the debate about "regulatory takings" of private property, mainly when it involves the requirement of collocation of entrant´s equipment in the incumbent´s premises. For the former authors, both, "*mandatory interconnection and unbundling constitute a government ordered, physical invasion of the property of the incumbent*". This

[18] The authors recognize, on the other hand, that this complementarity holds while the wholesale discount is not very high, leaving clear that this rationale depends on the level of regulated rental charges. For very low charges (high discounts), the two types of entry become substitutes rather than complements.
[19] See, for instance, Kahn (2004).

happens given that unbundling destroys the power of the incumbent to exclude others from using his property and also denies him the power to control the use of this property, which are fundamental aspects of the very meaning of "property rights". In this sense, Sidak and Spulber (1997) state that the Telecom Act of 1996 "*had turned the local telecommunications network into a kind of commons*", which they present as "*the tragedy of telecommons*". Worse, unbundling would be a taking for private use and, compared to the case of takings for public uses, the chances that the net result of the intervention will be positive is much smaller[20].

This holds even more true when the compensation is less than the actual value of the property taken, which creates a tendency for more intervention than is required. This is the case with the Long Run Incremental Cost (LRIC) rule or other price rule below the opportunity cost. Anyway, the main point is that, by not being the "residual claimant" on the full investment returns and gains from superior efficiency and quality, economic incentives are dampened.

The link of interconnection access charges and investment has already been studied by authors like Valletti (2003). High access prices foster facility-based investment of the entrant, bypassing the network of the incumbent, which may or may not be efficient. Both, wasteful (efficient) bypass on one side, but also efficient (inefficient) entry on the other, may be avoided with high (low) access prices.

The use of Long Run Incremental Cost (LRIC) regulated pricing increases incumbent's incentives for rival's service quality deterioration, a point noted by Laffont and Tirole (2000, p. 154/161) for interconnection pricing, which also fits the case for unbundling charges. The reason is that, at LRIC prices, customers who switch to the entrant would had likely generated more profits to the incumbent than the profits accrued in the access business[21]. According to the authors, these distorted incentives emerge because regulators usually disregard that the access to the incumbent's network (through

[20] The incumbent is also often mandated to provide customer database information to enable entrants to make their requests. The problem is that this is a legitimate sensitive information of the incumbent's business and its disclosure could also be considered a taking of an incumbent asset.

[21] The authors propose the global price caps to handle this problem. The Efficient Component Pricing rule (ECPR) would be another solution, since it incorporates the opportunity cost of the incumbent in providing access to the entrant as in Willig (1979) and Baumol and Sidak (1994). There are, however, several critiques against the rationale of the ECPR. See, for instance, Economides and White (1995) and Tye and Lapuerta (1996).

interconnection or unbundling) should also be considered as another "business" of this player and not only as a device to assist entry.

Like other authors, Laffont and Tirole (2000, p.154/161) stress that in telecommunications where cost-reducing technological innovations are pervasive and equipment is long-lived and sunk, regulatory attempts to base tariffs solely on the forward-looking most efficient equipment, as is the case of LRIC, is confiscatory, which harms investment and innovation. But the relationship seems actually not linear.

Chang, Koski and Majumdar (2001) show that in Europe, countries with interconnection pricing not based on LRIC have greater than average investment levels, while in the US, the opposite result holds, a lower access price spurs deployment of new technology by the ILECs. Cave and Vogelsang (2001) argue that the relationship depend on the stage of market liberalization in the sector. In the very beginning of this process, low access charges may not impact much the investment incentives. More important is that there is a regulatory-backed expectation that access charges will increase in the long run. In other words, what matters for investment incentives is not actual access charges, but the expectation for these prices in the future.

As LRIC hinges on specific network elements under unbundling, investment tends to be relatively more reduced in those targeted elements. This also represents a distortion on investment choices, which may be biased, according to Jorde, Sidak and Teece (2000, p.15) "*toward elements that are believed to be less susceptible to mandatory unbundling*".

More importantly, LRIC calculation is very complicated in practice, in view of different network configurations, and subject to manipulations from the regulator, who is used to be biased to privilege competition through "entry at any cost" instead of efficiency.

In the US, according to Hodulik, Batya, Hopper and Barron (2002) and Hazlett (2005), the total wholesale discount of UNE-P compared to retailing were, respectively, 45% in 2002 and 50% in 2003[22]. At the same time, according to Gregg (2005), nominal

[22] As shown by Crandall (2002), in the case of New York, low UNE rates and also a comprehensive availability of Verizon platform were obtained in exchange for the permission to acquire Nynex. That is why in 2000, around 1/5 of all new CLEC lines in the US were

average loop and UNE-P rates have declined, respectively, 3,7% and 9,7% from January, 2002 to August, 2005[23]. This trend has been reversed in the case of UNE-P prices, since January, 2005, with an increase of 2,4%.

Aron, Dunmore and Pampush (1998), Hausman and Sidak (1999), Jorde, Sidak and Teece (2000) and Pindyck (2004), among others, argue that when there is uncertainty on future demand or technology, there is a basic asymmetry that the LRIC methodology does not incorporate. If future demand turns high, the entrant requests unbundling and benefits from the good state of nature. But if demand turns low, the entrant just does not request unbundling and avoid losses that the incumbent has already incurred since his cost is sunk. As Pyndick stress, the entrant "*benefits on the upside, while avoiding the downside*". But this can be worse. As stressed by Hausman and Sidak (1999), even if the entrant requests unbundling and starts operating, nothing prevents that this operator decides to jump off if a bad state of nature realizes. So, unbundling pricing should explicitly incorporate the incumbent's exposure to risk, not incurred by the entrant, at the cost of restraining the investor´s returns to a level lower than the competitive one. This effect can be interpreted as a lost of the "option value" of the investment decision[24], and thus matters more when sector returns are more volatile and unpredictable, since the investor becomes more sensitive to swings in the macroeconomic environment[25], which is the case of broadband markets.

Jorde, Sidak and Teece (2000, p.22) add that more than adjust the LRIC, if the regulator removes mandatory unbundling, the entrant loses the possibility and is forced to balance the elimination of risk caused by postponing investment against the potential loss of market opportunities from entry. As a result, the entrant may invest or at least anticipate investment more often.

obtained in New York. For more detail on this antitrust case, involving two former Baby-Bells, and the compromises assumed to clear the merger, see Brenner (1997).

[23] The deepest average fall occurred with switching prices with a decrease of 56,4%. According to Wood, Zarakas and Sappington (2004, p.6), the potential profitability of CLECs have increased at least 45% between 2001 and 2003, and show through na econometric analysis that this "*has stemmed almost entirely from reductions in UNE prices*".

[24] Other authors have already explored the "real option theory" of the telecom investment decision, including its implication about the impact of unbundling on investment. See Hausman (1999) and Hausman and Sidak (1999).

[25] This hypothesis was tested by Ingraham and Sidak (2003), who found that the cost of equity, indeed, increased during a recession for three of the four ILECs. This result is the opposite of that found by Ekelund and Ford (2003), for which the former present a methodological critique.

Beard, Kaserman and Mayo (1998, p.318) points out that a price rule that would not discourage investment is the "retail minus avoided costs"[26] used quite often by regulators[27]. The rule establishes that the price be defined at the level of the retail price charged by the incumbent less the incremental costs avoided by this operator. In this case, according to the authors, "*if the return from retail-level services was sufficiently high that it previously created investment incentives, then the provision of these services at rates that reflect the "costs that will be avoided" leave the firm´s investment incentives wholly intact*". Moreover, the expected improvement on customer services with more competition would improve the profitability of services, increasing investment returns. The authors, however, disregard the role of "common costs"[28], not accounted in the "avoided costs", which implies a price less than the opportunity cost of the incumbent, reducing the incentive for investment.

Crandall (2002) argues that the Competitive Local Exchange Carriers (CLECs) in the US which built their own infrastructure were more successful in the telecom business than the ones which counted only with resale. The author stresses that unbundling can only succeed as part of a strategy of facility-based entry. One of the reasons is that if a CLEC is recurring to unbundling is because the ILEC already has an installed basis in the area and will compete with the former. Thus, it would be safer for the CLECs to focus areas not occupied by the ILECs which imply building their own facilities. In the case of resale, this problem would be worse, since as there are no barriers to entry, CLECs will enter until eliminate all gains over competitive returns, hardening life for ILECs and other CLECs as well[29]. On the other hand, Crandall recognizes that building network without building a previous customer basis, whcih can be achieved through an unbundled entry, revealed a risky strategy that explain the bankruptcies of some CLECs in the US.

Wood, Zarakas and Sappington (2004,p.8) show the trade-off between UNE-L and UNE-P entry. According to the authors "*a unit increase in the ratio of UNE-L to UNE-P*

[26] See Kaserman and Mayo (1997) for more detail on this methodology and Beard, Kaserman and Mayo (1998,p. 322/325) for a more synthetic presentation.
[27] The authors are defending that resale, in particular, does not discourage investment. However, the same rationale can be applied to any type of unbundling.
[28] This is also a problem in conventional LRIC as pointed by Sidak and Spulber (1997).
[29] Hazlett and Havenner (2003) argue that, even considering the non-incorporation of the option value in the LRIC, entrants are not actually able to obtain extra gains. As the right to request unbundling is not exclusive of one entrant, there is competition among entrants to capture these profit opportunities and the rents are fully dissipated in the process. This effect reduces financial gains of entrants, reducing the volume of funds available to go deep in facility-based entry. This would reinforce the idea that unbundled-based entry trades-off facility-based entry.

prices is associated with a four-fold decrease in the ratio of UNE-L to UNE-P CLEC access lines". A similar result is obtained by Crandall, Ingraham and Singer (2004) but for the relationship between the log-difference of UNE and facility-based lines and the log-difference of the respective costs. These results can be interpreted as a validation on the unbundled/facility based entry setting of the standard microeconomic theory of the firm with two inputs and a variable proportion technology. Each type of input (unbundled and facility) being taken as one input. Thus, from a static point of view they are nothing, but expected.

The most dynamic idea that unbundled entry can be a previous step for facility-based entry, i.e, they are intertemporally complements, even if substitutes in the short-run, is not challenged by the results above. However, Crandall, Ingraham and Singer (2004,p. 20) plot a regression between the change on the log-difference of UNE and facility-based lines and the log-difference of the respective costs to challenge the argument about the intertemporal complementarity of the two types of entry[30].

Hazlett (2005) also presents evidence on the negative intertemporal relationship between facility and unbundled entry based on financial market indicators. The author shows that the fall in investment in the last years was more rigorous in the telephone sector than in other information technology sectors and that the unregulated cable competitors outperformed DSL services. Furthermore, the evidence since the abandonment of line-sharing and UNE-P in the US (see below) is that CLECs, including AT&T, started adopting more vigorously emerging networks, that cable companies got renewed interest in investing to provide telephone service as they had been doing in the broadband business and that DSL started growing above its previous trend.

Pociask (2003) shows that reduced UNE prices in the US implied a 40% reduction on telecom investment between 2001 and 2002, resulting in an annual decline of output of US$ 101 per household, while the yearly estimated benefits of consumer price reductions caused by UNE competition was only US$ 11,41 per household. According to the author, the average avoided cost of incumbents in the US was 19,1%[31] while the regulated

[30] However, the authors quote this result *en passant* in their conclusions, taking it only as an "initial evidence", without further comments on the specific econometric exercise.
[31] The author also quotes Kovac (2002) who calculate the avoided cost as 5%.

discount to retailing was about 50% and 60%. UNE-P would work like a subsidy of US$ 203 per year from ILEC clients to CLEC clients. Since CLECs focus business customers, most of this subsidy is being paid from residential to business customers. Crandall (2004) finds that while ILECs lose about 60% of its revenue when it unbundles a line, it avoids only 10% of its costs, showing how unbundling prices were depreciated.

Bourreau and Dogan (2004) show a negative impact of unbundling on facility-based entry, but through a quite different mechanism. This would occur not because regulated unbundled entry becomes more profitable to the entrant compared to facility-based entry. On the contrary, the strategic behavior comes mainly from the incumbent. When this player feels threatened by a facility-based entry, he prefers to offer more attractive terms for unbundled entry, which would delay the building of new facilities by the entrant. In their model, the incumbent will have more incentives to supply unbundled wholesale services as long as the likelihood of facility-based entry is greater. The delay on constructing his own infrastructure is due to the fact that the entrant is already operating (on an unbundled-basis) in the market and that his new investment would replace part of those revenues already obtained[32]. This is nothing, but the "replacement" effect of the patent race theory[33].

Willig, Lehr, Bigelow and Levinson (2002), in the same line, show that with declining costs of facility-based entry, the incumbent has incentives to decline optimally the rental charge of the unbundled elements to keep avoiding the entrant from building his own infrastructure. So, the authors propose that regulators, at some point, should introduce a regulated price floor to unbundling elements to avoid this facility entry deterrence strategy of the incumbent and not a price ceiling as is usually done. The French regulator has actually vetoed a rental charge adopted by the incumbent in 2002 considered too low and thus deterrent for facility-based entry. Interestingly, this view is compatible with the critique of Mueller (1997 p.180/181) about the first attempt for an active interconnection policy in the US in the beginning of the twentieth century. According to this author, it was not the resistance of AT&T to interconnect that handicapped its competitors, but precisely the opposite. AT&T, as the almost single long distance network, attracted all independent

[32] See also Baranes and Bourreau (2005). The authors show that unbundling also distorts the entrant´s choice of technology in the future when building his own infrastructure.
[33] See Tirole (1988,p. 394/399).

companies to operate under its standards, which eliminated the stimulus for facility-based entry.

According to Crandall (2004), the decline in capital expenditures was greater in the US states that reduced their UNE-P rates. The most interesting argument of the author is about the reversion of the causality between UNE-P rates and investments in the US. The Bell Companies which increased more their investment between 1996 and 1999 were associated with lower UNE-P rates in 2002, which means that the regulators actually punished investment activity.

Hausman and Sidak (2004) show that in 2000 only ¼ of a sample of 17 CLECs increased their share of facility-based entry to unbundled-based entry, while 8 of them kept their share constant in this year. This would go against a systematic verification of the intertemporal complementarity hypothesis.

Clarke, Hassett, Ivanova and Kotlikoff (2004), contrarily to the analysis above, argue that actual UNE-P rates in the US exceed what would be the TELRIC UNE-P rates by 27,9%, which indicate that regulated charges were too high and not too low. The authors, based on an econometric model, show that telecom investment and employment outlays would increase between 20% and 30%[34] and local rates would drop between 8,7% and 30% if UNE-P prices drops to the TELRIC level. These results are attributed to the fact that CLECs showed a relatively higher propensity to invest than ILECs and that the investment of these firms are strategic complements rather than substitutes.

From a theoretical point of view, De Bijl and Peitz (2004) constructed a simple model, showing that an increase in the rental charge, when total consumer coverage of the service is assumed constant, does not impact the entrant's profits, but represents a transfer from consumers to the incumbent, with total welfare unchanged. This represents a suitable hypothesis for the voice market, but not for the more elastic broadband segment, where a lower rental charge may increase penetration. The authors, however, recognize that a low rental charge reduces the incentives of the entrant to invest and thus an increasing series of

[34] Hassett and Kotlikoff (2002), in an earlier exercise, reached capital investment increases up to 60%.

lease prices along the time could be imposed to stimulate the passage from unbundled to facility-based entry.

The most influential empirical article in favor of unbundling was by Willig, Lehr, Bigelow and Levinson (2002). They find that a 1% reduction in UNE rates generates an increase of ILEC investment between 2,1% and 2,9%, confirming that this variable is strategic complement with the CLEC´s investment.

Several studies have been focused on the impact of unbundling in broadband penetration in view of its prominent impact on economic development and efficiency[35].

Gabel and Huang (2003) find a positive impact of the ratio of forward looking UNE price to embedded costs on the deployment of advanced telecommunications services and on facility-based competition. Howell (2002), Aron and Burnstein (2003) and Hoffler (2005) show in cross-country studies that unbundling has negligible effect on broadband penetration. The authors also find that interplatform competition is what significantly influences broadband penetration. Ford and Spiwak (2004) find a positive impact of unbundled loop prices based on TELRIC on the availability and number of competitors in broadband services. According to Wallsten (2005), in the US, while UNE lines are negatively correlated with broadband penetration, resale is positively correlated with that variable[36].

Distaso, Lupi and Manenti (2005) show that inter-platform competition and not DSL competition (that uses unbundling modalities) is being the main driver of broadband penetration in Europe. Although the econometric exercise shows a positive impact of more unbundling (measured through a lower rental charge) in broadband penetration, this is not significant. Despite the positive impact of more DSL competition, a lower unbundling price also decreases inter-platform competition, offsetting the first effect. According to the authors, unbundling policies will only be successful to foster broadband adoption if complemented by policies to foster inter-platform competition.

[35] See Wellenius and Townsend (2005,p. 594/612), Ward (2003) and Nadiri and Nandi (2003).

Woroch (2002) proposes an oligopoly model for broadband and shows that when: 1) there are two competitors, the incumbent and the entrant who uses unbundling and 2) there are three competitors, the incumbent, the entrant who uses unbundling and a third player (cable) not mandated to unbundle, investment is delayed. On the other hand, by mandating the incumbent and the third player to unbundle, investment is accelerated. This work has the extra purpose of showing the impact of asymmetric regulation, concerning unbundling on cable and incumbent telecom operators. The policy prescription is either to remove unbundling obligation from the telephone incumbent operator or to mandate cable companies to unbundle their networks. Zarakas, Woroch, Wood, Mcfadden, Ilias and Liu (2005) work with four competitors, adding a facility-based competitive local exchange carrier and find that higher UNE prices (15% and 30%) increase investment of the three facility-based competitors (respectively, 1,6% and 3,2%), an impact that is greater to high-speed lines compared to voice lines. Moreover, the negative impact of low UNE rates on investments in data services is higher for the facility-based CLEC (a elasticity of 1,05) and the cable TV company (0,49 elasticity) compared to the ILEC (0,17 elasticity).

Garcia-Murillo (2005) shows that the impact of unbundling on broadband deployment depend on the stage of development of the country. While unbundling brings no impact for high and low-income countries broadband penetration, it does for middle-income countries. The reason may be that in high (low) income countries, broadband investment by competitors is (not) attractive with or without unbundling.

The European Union today counts strongly with the idea of intertemporal complementarity based on what Cave (2004) baptized as the "ladder of investment", which is also called by Americans as the "stepping-stone" theory[37]. According to this idea, it is important to provide easy and inexpensive access to incumbent´s non-replicable assets, being that "*at the outset this might include a large number of assets, which initially are complements to the entrant´s investment, but with time become substitutes*". In the specific case of the broadband market, the author also points out that competition is a "*dynamic process, involving migration of operators from one entry or access point to another*", with a specific interest on the role of the diverse kinds of bit-stream access.

[36] The author points out, however, that this positive correlation effect with reselling may be related to the fact that UNE-P and resale are substitutes. In this sense, the positive correlation between broadband penetration and resale would just add to the negative correlation effect of UNE with broadband.

Cave (2005a) stresses the importance of focusing the intervention on non-replicable assets, proposing a two-stage test on non-replicability, by checking, first, the degree to which operators have actually built their own assets. For the author, UNE-P policy in the US represented a "ladder policy in reverse" including replicable elements, which dampened investment. The second stage is to check for the existence of relevant economies of scale or density, which reduces the scope for unbundling intervention. According to the author, the least replicable element is clearly the copper loop. The replicability of the DSLAM on type I bit-stream (see figure 3) vary with the scale economies of DSLAMs, including its fixed costs of collocation in the incumbent´s office compared to the number of subscribers. In type II Bit-Stream, replication is even more feasible, while types III and IV bit-stream are highly replicable.

One possibility for regulatory activism on fostering upgrading is the introduction of sunset provisions, establishing a maximum term for State mandatory intervention[38]. It could improve the chances that the upgrading predicted on the argument of "ladder of investment" will hold. This was actually introduced in Canada, but abandoned afterwards. Chistodoulou and Vlahos (2001) state that the Netherlands offered initial low LLU prices, but with an explicit rule for those prices to increase up to LRIC prices, providing the correct price signals for the investment decision of entrants.

In this sense, the "ladder of investment" concept does not envisage a "passive" role for the regulator in the sense that upgrading may not occur naturally without proper regulatory incentives for operators to do so. According to Cave (2005a) regulation should be designed by encouraging entrants "*to climb the ladder driven both by the attractiveness of the rungs above (relative to staying where they are) and by fear that the rung on which they are currently standing will be less comfortable*". Also, the EC report (May, 2005) indicates that the role of regulators within a "ladder of investment" approach should "*not only encourage access, but may actively support the upward move by signaling either through dynamic pricing or sunset clauses that regulation will be removed (thus new*

[37] See Hausman and Sidak (2004).
[38]Jorde, Sidak and Teece (2000,p.29) proposed a maximum term of two years or upon the entry of a facility based competitor.

entrants should not establish themselves forever on a particular rung, i.e. business models should not be built on the unlimited availability of specific mandated access products".

In Italy, as shown by Gallo and Pontarollo (2004, p. 12), the regulator established a general principle that retail and wholesale prices should respect the following inequalities:

Wholesale Price for Full LLU < Wholesale Price for Bitstream < Wholesale Price for Resellers < Retail Price of the Incumbent

According to the authors, this rule would be consistent with the "ladder of investment" approach, since it provides the incentives for entrants to climb the ladder and reach cheaper rates with Full LLU. Notice, however, that these inequalities do not guarantee the appropriate incentives for the ladder of investment, since it does not incorporate the costs of entrants. More consistent with an active role of the regulator to foster the "ladder of investment" mechanism would be the following inequalities:

Wholesale Price for Full LLU + Cost of the Entrant in Operating a LLU Line < Wholesale Price for Bitstream + Cost of the Entrant in Operating a Bitstream Line < Wholesale Price for Resellers + Cost of the Entrant in Reselling < Retail Price of the Incumbent

Another problem is how to distribute optimally incentives to climb the ladder throughout entrants, who are located at different rungs without breaking the usual non-discrimination provisions on telecom regulation and avoiding undue privileges to late comers, since those latter could get better conditions compared to former entrants who remains at a particular rung. Anyway, Cave (2005a) stresses that the regulator should privilege "leading competitors", more advanced in the process of infrastructure building. Sunset clauses for the regulatory enforcement of the arrangement (2 to 3 years) and/or increasing rental charges to foster climbing the ladder should be designed. Cave (2005b) states that Ofcom has explicitly adopted this kind of policy, increasing the margin between prices of entry at different points of the bit-stream rungs.

Cave (2004), on the other hand, recognizes that "*not all operators will wish to ascend to the top of the ladder. Depending on their business plans they will stop at various places"*. This means that, for the author, bit-stream is not only a strategy to foster the "ladder of investment", but also to foster competition, albeit limited, at some specific point of the network, which clearly depends on the value of competition at this point. Moreover, if a network element is not replicable and tends to remain non-replicable even when the customer basis is enlarged with unbundling, the regulatory goal may not be facility-based entry in the long run through the "ladder of investment" mechanism, but the value of the short-run competition by itself.

This question has an interesting implication for the incentive of the incumbent in being cooperative or not with the entrant in unbundling. As long as the entrants are expected to stop earlier and do not continue "climbing the ladder", the incumbent may be less resistant in supplying access for any given regulated access price. This is because the incumbent has two possibly incentives for not being cooperative. First, from a static perspective, the lower the regulated rental charges, the higher the opportunity cost of the incumbent providing access at any point of his network. Only at a free and profit-maximizing access price, this source of disincentive to cooperate would be eliminated.

Second, from a dynamic perspective, when the entrant climbs the ladder, he increases the space (and thus the value) of competition with the incumbent. This would not be a problem for the incumbent if there is no access charge regulation and the entrant does not climb the ladder fully, not building his own local loop. In this case, with entrants at least as efficient as the incumbent, the latter is able to charge the monopoly price to the formers and keeps or even increases his profits when unbundling. However, if the incumbent expects that the "ladder of investment" mechanism holds until a full facility based entry, including the local loop, he knows that his monopoly profit may drop substantively in the future by being cooperative today. Even if there is no access charge regulation and the entrant is more efficient, increasing the incumbent´s short-run profits, he may have an incentive not to cooperate in view of the perspective of losing monopoly profits in the future. Discount rates will be crucial in this case. The less the incumbent discounts the future, the less cooperative he tends to be by fearing a full completion of the "ladder of investment" mechanism.

But the greater the perspective for the entrant to climb the "ladder of investment", the more valuable is his competition for the sake of reducing allocative inefficiency through upstream competition in the sector. So, the more valuable is the competition expected to be brought by entrants in the future by climbing the "ladder of investment", the less cooperative the incumbent may be[39]. For competitors not interested to climb to the top of the ladder, which thus is not so valuable for competition, the incentive not to cooperate depends only on how close the regulated access charge is to the profit-maximizing one.

The idea of Borreau and Dogan (2004) and Willig, Lehr, Bigelow and Levinson (2002) about the incentives of the incumbent to persuade the entrant not to build his own infrastructure through lower rental charges also has implications for the "ladder of investment" rationale. Indeed, sunset clauses or declining prices to foster the "ladder of investment" mechanism throughout the types of unbundling that add more value may have the opposite result. Low rental charges for Full LLU to stimulate passing from resale and bit-stream to Full LLU may also stimulate the entrant to get stuck in this level, postponing the completion of his facilities. Ideally, according to the authors, the regulator should commit to ban even voluntary unbundling agreements to avoid that the incumbent use it strategically to postpone full facility-based entry.

Hausman and Sidak (2004) addressed for US, UK, New Zealand (where there is no mandatory unbundling), Canada and Germany, the relationship of unbundling with reductions on retail pricing, increases on wholesale competition and investment, the verification of the "stepping-stone" or "ladder of investment" hypothesis and the existence of sufficient entry barriers in the telecommunications sector to justify that policy. The general conclusions of the authors were that "*with a few possible exceptions, the rationales for mandatory unbundling do not appear to be substantiated in practice. The clearest example is the stepping stone hypothesis, which fails to be substantiated in any country in our survey……CLECs generally appear to remain dependent upon unbundled elements*

[39] Cave (2004) recognizes this incentive not to cooperate behind the ladder of investment concept: "*In a strictly static context, a firm with upstream market power would maximise its profits by seeking access to the most efficient downstream operator. However in a multiperiod context, the integrated firm might anticipate the possibility, for example, that the retail competitor might choose, when it had collected an adequate numbers of customers, to integrate backwards into the upstream services*". Mattos (2002 and 2006) develops models of vertical foreclosure where the incumbent is uncertain about the future cost of the downstream entrant in the upstream segment or about the result of a patent race with the latter. For a sufficiently low expected future cost of the entrant, the incumbent forecloses deteriorating quality.

and have made little attempt to substitute those assets with their own facilities". Furthermore, *"the entry barrier hypothesis, which implies that mandatory unbundling is necessary to overcome entry barriers in local communications is rejected…..Finally, competition from CLECs generally does not appear to lower retail prices, with the possible exception of the decline in internet access prices in Germany following the imposition of mandatory unbundling……There is scant evidence that entrants "innovated" by bundling voice and data services under a single offering…..Stated differently, the only "innovation" offered by entrants came in the form of branding and distribution rather than improvements in networks and other infrastructure* ".

In the UK, for instance, price declines seem to have occurred in response to competition between DSL and cable and not among DSL providers. In this country, there was virtually no conversion of unbundling entry on facility-entry since a high level of the latter have already occurred before mandatory unbundling in the context of the IT bubble.

4. Problems in Implementation of Unbundling and Vertical Foreclosure

In unbundling, like in interconnection, the required strong technical interface with the incumbent raises the possibility that this player deliberately deteriorates the entrant´s quality. Viscusi, Vernon and Harrington (1995) show how this practice was explicit in the interconnection of MCI with AT&T for the long distance service in the seventies. To be able to make long distance calls through MCI rather than AT&T, end-users had to dial more 9 digits (20 digits) compared to the service made through AT&T itself (11 digits). The justification of AT&T for the differentiated treatment was based on technicalities that were difficult for regulators to verify. The fact was that, because of this and other differences of quality not intrinsic to MCI´s own efficiency, the company was considered as a lower-quality operator and had to offer some discount to compete with AT&T.

Entrants worldwide, fairly or not, continue to complain against price and non-price discriminatory practices of incumbents in interconnection, which usually remains difficult to verify. Those practices can assume very subtle forms, being performed not only through incumbent´s action, but also through simple omission. Incumbents may just care less with

receiving off-call failures compared to receiving on-net call failures. This may occur also because the incumbent devote poor internal resources to entrant´s interconnection point compared to his own trunks. Furthermore, it may be quite hard for the regulator to check whether delays in fixing troubled points of interconnection are due to lack of incumbent´s goodwill or not. As stressed by Crandall (1002, p.27), CLECs accused the ILECs for not being able to install their services in the agreed dates or for having their calls disconnected or poorly routed. ILECs reply that CLECs make mistakes when routing calls.

At the theoretical level, Laffont and Tirole (2000) associates non-price discrimination with the low profitability of the access business resulting from LRIC regulated pricing. Economides (1998), Sibley and Weisman (1998), Mandy (2000), Weisman and Kang (2001), Mattos (2002 and 2006), Sappington and Weisman (2005) –for self-sabotage- and Sand (2004) explore the general issue of non-price discrimination in vertically integrated companies when they provide inputs to downstream competitors[40].

For Spiller and Ulset (2003), transaction costs are exacerbated in the unbundling contract in view of their complexity, which makes it particularly "incomplete". Notice that the debate on the actual irrelevance (or relevance) of incomplete contracting as limiting the set of pay-off outcomes that can be achieved ex-post, like that developed by Maskin and Tirole (1999) and Tirole (1999)[41] in one hand (for the irrelevance) and Hart and Moore (1999) in the other (for the relevance) does not apply here. This is because the main problem of the unbundling contract is not the possibility of ex-post opportunism after the most conventional hypothesis of a mutual valuable ex-ante transaction. In interconnection and unbundling, high contract incompleteness combines with the lack of ex-ante incentives of the incumbent for cooperation with the entrant, which enhances enormously the conventional transaction costs. According to Spiller and Ulset (2003), this "*creates numerous opportunities for strategic ploys and legal maneuvering*", being that "*costly and time-consuming litigation and regulatory processes are more the rule than the exception*"[42]. This requires heavier regulatory intervention.

[40] All this literature can be considered as one branch of the answers against the Chicago critique from Bork (1978) and Posner (1976), who argued the lack of economic rationality in the foreclosure conduct.
[41] Those authors provide sufficient conditions for which the indescribability of contingencies does not restrict the set of pay-offs that can be achieved through contracting between parties. Moreover, even the definition of incomplete contracting is considered not clear at all for these authors.

The beginning of unbundling in the US illustrates the difficulty to induce free and cooperative negotiation between parties. As described by Hausman and Sidak (2000), "*by the fall of 1996, entrants and ILECs were unable to reach any voluntary agreements on the pricing of resale and unbundled network elements. As a consequence, hundreds of arbitration proceedings began in the fall of 1996. In most cases, each arbitration was a one-on-one proceeding between a single entrant and the ILEC"*.

Also, according to the reports of the EC, progress in this policy in Europe is basically constrained by its "*technical complexity*" and the *"imbalance in bargaining power between incumbents and new entrants*", which require detailed involvement of regulators. In Europe, as stated by Bourreau and Dogan (2004, p.300/301), there are several complaints of entrants on quality degradation in unbundling. In Germany and Denmark, entrants complained that incumbents provided unbundled lines of poor quality or even not functioning at all. Thus, quality issues may arise before or after some line is unbundled. Lack of supply of information for the appropriate operation of a given line is also an usual complaint.

Epstein (2004) quotes the case of Covad, that charged Verizon for stonewalling the collocation of facilities, refusing to test loops and overcharging. On other hand, Verizon sued Covad with the allegation that the latter instructed its employees to file false trouble reports to help in the former suit.

There is no systematic empirical evidence about the relative frequency of true complaints of entrants on non-price discrimination from incumbents. On the contrary, for the US, Crandall (2002) addressed a set of successful and non-successful CLECs and show that the CLECs which failed to succeed adopted poor business strategies, including excessive expansion, and incumbents could not be blamed for it. The author also points out that "*ILEC networks were not designed with the knowledge that CLECs would be allowed to immediately interconnect to the network owner wherever and whenever they desire*". As claimed by the author, the ILEC network may just not be designed to CLECs´ business strategies[43], which is not, *per se*, an indication of non-price discrimination.

[42] See more on this applied more generally in Spiller (1997).
[43] In the case of interconnection agreements, Crandall (2002) also stress that only 126 out of 10.342 interconnection agreements (1,2%) between CLECs and ILECs in the US involve formal dispute, which would be a clear sign that, if there was some non-price

Indeed, the general pattern of unbundling worldwide has been of delayed concrete implementation up to two/three years after the policy has become mandatory or after regulators have started, even through informal means, "encouraging" incumbents to provide a commercial offer to entrants. In the UK, as reported by Bourreau and Dogan (2004, p.301), the regulator obliged the British Telecom to pay a compensation to the entrant whenever it failed to meet contractual obligations, in particular delivery of lines, which would be based on an estimate of the entrant´s loss.

Unbundling became mandatory in practically all developed countries, with intense negotiation of the regulators with the incumbents to cope with implementation problems, including the issuance of guidelines providing minimum requirements for the offers. In Europe, for instance, the European Commission (EC) mandated that the incumbent in each member state issued a Reference Unbundling Offer (RUO), with minimal pre-defined requirements, describing the main commercial and operational characteristics of the contract.

Unbundling price regulation is also a highly contentious issue. In countries like France and the UK, the regulator intervenes ex-ante to settle prices, while in Denmark and Finland the regulator intervene, if required, after free commercial negotiations take place. While the EC provides a general guideline for cost-based pricing, actual implementation also differ among EU countries. LRIC and retail minus avoided costs are quite used.

Even being usual the pre-negotiation of the incumbent's offers with the regulator and entrants, they are often revised several times by the regulator within the same mandated guidelines and/or through revised guidelines. Furthermore, the regulator tends to mandate a more comprehensive unbundling policy and lower prices at each new revised guideline, which requires a revised new offer.

There is a common pattern of difficult negotiations on pricing, collocation and spectrum management on broadband local loops. Actually, availability of collocation space

discrimination, this was the exception. Of course, CLECs may also be tolerant with non-price discrimination because of the difficulty to prove and the need to keep good relations with its input provider, the ILEC.

in incumbent exchanges is often one of the main important problems of unbundling implementation, mainly when there is a number of entrants demanding space at the same time. Space at the incumbent exchange office becomes a scarce resource and the need for regulatory arbitration turns more urgent.

At the same time, unbundling requires close operational co-ordination between the incumbent and the entrant, which can also be dampened by harsh negotiations in the processes of a) ordering; b) provisioning; c) billing; d) fault handling and e) service-level agreements (SLAs).

As pointed by De Bijl and Peitz (2005), several times, unbundling requires the upgrading of the incumbent's main distribution frame, a process that can be deliberately slowed. Also, according to the OCDE (2003), line qualification testing is required by incumbents to determine whether the local loop, mostly at the switch office, is qualified for provision of xDSL services. An issue is whether the incumbent must test their loops on demand for each order from a new entrant. On-demand testing might slow the process and provides information about the entrant´s business plans to the incumbent, as stressed by Noam (2001,p. 171), whereas comprehensive testing (pre-qualification) can be an excessive burden for incumbents. However, it is expected that the development of xDSL services will spur the improvement of efficiency in testing with the emergence of new testing technologies.

Each specific type of unbundling faces its own set of difficulties concerning the operational relationship between the incumbent and the entrant. The OCDE Report (2003) provides a good overview on the technical differences among the main types of unbundling, for which we provide a brief summary.

Full LLU

New entrants request the incumbent to install and disconnect services for their users by sending an order form to the incumbent. At this time, the latter may delay replying to the former, postponing the confirmation of the switch to the customer. The incumbent can argue that standard bureaucratic procedures have to be completed or that staff is

particularly busy with other priorities. According to Clarke, Hassett, Ivanova and Kotlikoff (2004), CLECs also accuse ILECs of using slow and error prone manual rather than electronic hand-offs to proceed the hot-cut. Depending on the time spent, lack of willingness from the incumbent can be hardly verifiable or even observable for the ordering.

After the order is confirmed, the actual cut-over process to disconnect the loops from the incumbent's network and reconnect it to the new entrant's network takes place. Once more, although being a simple technical process, incumbents can delay it, since the procedure has to be undertaken by a team employed by the incumbent. Once more, internal bureaucracy and busy staff can be claimed as motivations for delays.

Customers can attribute delays to entrant's incompetence and not to the incumbent's actions, which hurts entrant's quality reputation. However, even worse, the hot-cut process can cause real damage to customers, mainly business ones. According to the OCDE Report (2003) "*it is also often the case that the incumbent refuses to undertake the cutover outside of business hours, which can have a negative impact on business users*". If the period of time between switching-off incumbent's line and switching-on entrant's line is sufficiently large (hours), once more, customers may blame the entrant rather than the incumbent. For business, even a few moments off-line can represent serious financial damage (imagine a company in Wall Street!!).

The main point is that during this transfer or switching process between the incumbent and the entrant, it may be difficult for customers to distinguish which problem is caused by each operator.

After the hot-cut process, although the entrant takes total control of the copper pairs, the incumbent, besides keeping ownership, remains responsible for maintaining it, including the provision of fault-handling services. There is also room for the incumbent not to cooperate and jeopardy the service of the entrant, through delays or even less than perfect maintenance and repair provision compared to what he does for his own customers. At this moment, the customer tends to attribute all problems to the entrant and eventual incumbent's sabotage may be even more effective.

It is also more difficult to observe and detect incumbent's non-cooperation ex-post since it represents a more subtle form of negligent behavior compared to delays on ordering and provisioning (the hot-cut). According to Spiller and Ulset (2003), the biggest operational impediment may be the incompatibility of the operational support systems (OSS) of the entrant with the incumbent, being that the information contained on it is key to a successful entry. As the incumbent´s OSS was not configured to serve the entrant, but its clients, it is difficult for the regulator to discern whether remaining compatibility problems are due to lack of goodwill of the incumbent or not.

Anyway, the incumbent may simply not allocate his best resources, including staff personnel, to look after a Full LLU line maintenance as compared to what he does for the lines where he himself retails. Since this is a very internal procedure, it is very difficult to observe and verify.

UNE-P x UNE-L

According to Clarke, Hasset, Ivanova and Kotlikoff (2004), operational and cost impediments are greater in UNE-L compared to UNE-P, which is, in practice, a resale transaction. Indeed, the separation of specific elements of a network tends to be more complicated compared to the transaction with a full and integrated set of elements.

On the other hand, departing from a single element, the local loop, transaction costs may increase with the number of other elements requested until a threshold from which more aggregation reduce transaction costs. Unbundling of more interactive elements may reach this threshold earlier.

Line-Sharing

Once more, non-observable and non-verifiable deliberate delays in this process may occur, but with extra operational difficulties. According to the OCDE (2003), a primary difficulty of line sharing has to do with technical interface problems. For example, implementation of ADSL with telephony and with ISDN uses different spectrum allocation

so that different equipment may be necessary both for the splitter and for ADSL. In addition, line sharing may slow down the speed for digital access due to "frequency unbundling". When high-speed data runs along adjacent telephone lines, the signal on one wire can bring noise into the next wire, interfering with the signal and resulting in slower data rates. This problem is known as "crosstalk", a mutual potential negative externality, which has to be technically overcome in order to expand ADSL access via line sharing. Furthermore, the incumbent has an extra-cost to install a splitter suitable for both networks. In this case, there is an operational alibi for delaying the delivery of the service to entrants, which can be even harsher than in the case of Full LLU.

While there are more potential ex-ante problems in line-sharing compared to Full LLU, there are less potential ex-post problems since the incumbent also has customers who use that line for voice services. Anything the incumbent does to jeopardize quality of service may also affect his own customers in the voice segment. This happens since the line is the same for both services and eventual attempts to sabotage entrant's broadband service may also affect the incumbent's voice service. It will be more difficult for the incumbent to be "selectively" negligent with the entrant´s service without jeopardizing his own service.

The incumbent still has more incentives to care about lines where he provides both services voice and broadband rather than only voice, mainly because line sharing prices are regulated. So, he still tends to devote the best of his personnel and other resources for lines where he also sells broadband services.

Line-sharing may also represent, compared to Full LLU, a lower opportunity cost for the incumbent since only xDSL and not the voice business is released to the entrant. Of course that this is less true as long as the broadband market is relatively more attractive than the voice market, which was taken as a "digital cream-skimming" by Jorde, Sidak and Teece (2000,p. 27). This actually occurs when this segment is in its birth and there is a "first" or "second" mover advantage rents envisaged by telephone incumbents. Notice that the "second" mover advantage may also be very relevant when incumbent telephone operators believe that xDSL technologies will take over conventional first-movers technologies associated to cable companies. Broadband is also growing more rapidly,

while fixed voice telephony demand is stagnated. Moreover, if the entrant uses VOIP to provide voice service, the opportunity cost of line-sharing may get very close to full unbundling.

On the other hand, the presence of relatively stronger alternative operators through wireless, fibre, satellite and mainly cable, are making broadband markets increasingly more elastic for individual firms than the voice service. This means that where broadband competitors have already developed enough, the opportunity cost of providing line-sharing to entrants is even lower compared to Full LLU, softening incumbent's natural lack of goodwill to be cooperative in implementation.

Bit-Stream and Resale

The same remarks concerning the opportunities of the incumbent to delay ordering and provisioning and also to deteriorate entrant's service quality are valid here, with the difference that the control of the DSLAM (and also other devices depending on the option of bit-stream) provides one more interface opportunity for "selective" negligence or even deliberate sabotage of entrant's service. As the incumbent holds much more control of the operation than in other cases, the capacity to detect deliberate sabotage decreases relatively to line-sharing. Furthermore, as long as we move from (1) to (4) in figure (3), the opportunities of the incumbent for poor care of the entrant's bit-stream extension and/or explicit sabotage, with smaller risks of being detected (observed or verified), increases.

Second, the possibility to remain supplying broadband reduces even more the opportunity cost of the incumbent to provide the wholesale service to the entrant compared to the other two alternatives. Once more, this softens the incentive for non cooperation. The relative effects of these two factors push the problem of "contract complexity" to opposite sides.

The OCDE (2003) also points out that bitstream access can lead to line interference in specific situations depending on the xDSL technology used. For example, in the case of simultaneous use of xDSL technology by more than one operator, there may be difficulties

in operating at the same time. In such a case it is difficult to identify the ultimate source of disturbances, which dampens the capacity of the regulator to verify both, the incumbent and the entrant behavior.

In resale, there are also plenty of opportunities to deteriorate the quality of the entrant's services. On the other hand, ordering and provisioning procedures should be faster than in any other type of wholesale transaction, since there is no operational procedure to be done. In other words, the alibi for ex-ante deliberate delays is clearly the least convincingly of all modalities.

Sub-Loop Unbundling

According to the OCDE (2003), "*technical problems can arise when the incumbent extends fibre beyond the local exchange to the users' premises. In this case, the exchange area is usually converted to a digital carrier transmission (DLC) standard and the copper pair will terminate at the point between the local exchange and the users' premises (remote terminal) instead of on the MDF. The interface point between the fibre and the copper pairs will be located in an access junction or cabinet in the street. Such fibre-in-the-loop systems might expand if incumbents roll out more DLC systems to support their own broadband services. Since the xDSL modem must electronically match the digital interface at the remote terminal, new entrants will have difficulties to provide their own broadband services if the incumbent seeks to limit the equipment that can be placed at the terminal. If the incumbent tries to roll out DLC technology in local loops after the deployment of competitors' xDSL services in the exchange area, the competitors will be obliged for technical reasons to reconfigure their network at the risk of making redundant investment*." Of course, this can be also be a deliberate attempt of the incumbent to ex-ante delay entry, an issue usually explored in the literature about standards[44]. The incumbent can also switch standards with the purpose of making them incompatible with the entrant's.

[44] Non-cooperative behavior of the incumbent by changing standards can also be used in other unbundling modalities. There is a well-established literature in the economics of standards, with early surveys from Katz and Shapiro (1994), Besen and Farrel (1994) and, more popularly, Shapiro, Farrel and Varian (2004). Our point is that in sub-loop unbundling this potential problem is enhanced. The main economic question is that the social benefits that one company generates when it makes its technology compatible with others are spread over all other companies and thus social benefits exceed private ones which lead, with more than one firm in the market, to an equilibrium level of standardization lower than the social optimum.

Regulators may not only care with incumbent's behavior. Introducing compatible equipment for unbundling requires time from the incumbent, even with his best goodwill. And a successful business for entrants require timely deliver for interested clients. So, successful unbundling requires previous estimates from entrant about the number of lines and even the initial and future collocation space, besides network information. Entrants tend to make overoptimistic forecasts, which can oblige the incumbents committing excessive resources. On the other hand, as stressed by Jorde, Sidak and Teece (2000, p. 21), "*the requesters, however, are not required to make firm commitments to take specified volumes of the UNE for a minimum contract duration*". So, the regulator must care about the proper distribution of risks on planning unbundling infrastructure. Costs must be imposed on entrants in case of overoptimistic estimates.

A common feature of unbundling with Full LLU, Line-sharing and Sub-Loop Unbundling is the need for collocation of entrant's equipment at the incumbent's office for the appropriate interface with the loop. Collocation uses to take time[45], which frequently raises complaints from entrants in several EU countries. Collocation charges are also a contentious issue. There are four types of collocation:

1) "Caged collocation", which establishes a physically separate space from the rest of the incumbent's exchange by wire mesh or solid partition. In this case, there is like a "wall" dividing the equipments of the incumbent and the entrant. As stressed by the OCDE (2003), caged collocation can provide greater security for new entrants within their own separated space as well as for the incumbent within the building;

2) "Co-mingling" or "cageless collocation", in which the new entrant's equipment is placed together with that of the incumbent. This is a less expensive alternative for the entrant, but at the cost of becoming more vulnerable to the incumbent's actions. However, between those two alternatives, incumbents usually prefer "caged collocation" that confers a more precise separation of operators' equipment.

In these first two cases of collocation (caged and cageless), the incumbent has to provide easy access to entrant's equipment in the incumbents' switching offices, which can

[45] More than six months in Germany and Belgium as reported by Bourreau and Dogan (2004,p. 301).

be ex-post a potential source of trouble, which may be easily remedied by regulatory interference.

3) "Virtual collocation", where the new entrants' equipment is installed and maintained by the incumbent on its premises and new entrants do not have access to these premises. Depending on the (usually formally or informally regulated) price charged by the incumbent for this collocation, it can be more or less expensive for the entrant than the other two alternatives. The degree of vulnerability of the entrant to incumbent's action is maximum in this case, if compared to the other two cases.

In these three cases, mainly the first two, space constraints at the incumbent's central office switch may be a real issue and quite often, incumbents claim, rightly or wrongly, about that. And, indeed, if space is actually a scarce factor in the incumbent's central office, there is a conventional "tragedy of commons" problem emerging from collocation: any new entrant does not care about the increase on office space scarcity generated by his own collocation of equipment, a non-internalized externality. Ex-ante delays are usually attributed by the incumbents to the necessity to undertake an assessment of additional floor loading.

In case of line sharing, real collocation space-related problems may be more acute than in Full LLU. According to the OCDE, this is because there are two connections required, one for each shared line, which requires a larger MDF, and also a splitter which occupy further space[46].

Other issues with frequent conflicts among incumbents and entrants, as stressed by Spiller and Ulset (2003), are the types of equipment allowed in the exchange building, the terms of access for entrant´s staff at the exchange building, the overall joint security of the premises and liability for eventual damages.

The incumbent often demands that collocation follows the fourth case:

[46] That is why collocation prices in line sharing is often higher compared to Full LLU.

4) "Remote collocation", in which the equipment of new entrants is installed on premises near the incumbent's building. The problem is that this is not easy to obtain and the required extension of the length of copper pairs may reduce entrant´s quality. So, aware of this disadvantage, this is also the case that the incumbent may be attempting to induce remote collocation, even if commonality is not a real problem. This is, *par excellence*, an indirect way to raise rival costs through motives that may be difficult for the regulator to observe and verify whether they are reasonable or not[47]. We can summarize unbundling implementation problems in the following table:

[47] See OCDE (2003) for the types of collocation in developed countries, country by country.

Table I - Implementation Problems in Unbundling

Characteristics	Full LLU	Line-Sharing	Bitstream	Resale	Sub-Loop
Ex-Ante Implementation Problems	Delays on Ordering and Provisioning (Hot-cut). No interface problems.	Delays on Ordering and Provisioning. Interface problems are sharper.	Delays on Ordering and Provisioning. Incumbent has to install the DSLAM and, eventually, the ATM and the IP backbone.	Delays on Ordering and Provisioning, but with a less convincingly alibi than the others.	Delays on Ordering and Provisioning. Higher complexity for interface design.
Ex-Post Implementation Problems	Negligence through poor Line-Maintenance and Fault-Handling. No operational complexity.	Poor Line-Maintenance and Fault-Handling may compromise the incumbent's own clients on the voice service. Selective negligence or sabotage may be more explicit and thus more detectable.	More opportunities for undetectable selective negligence and sabotage than in line-sharing.	More opportunities for undetectable selective negligence and sabotage than in bit-stream.	Higher operational complexity for interface operation. Different possibilities of sub-loop unbundling turn regulatory task more burdensome.
Collocation	Real and fictional Space Scarcity Problems.	Space Scarcity Problems may be even more relevant than in Full LLU.	No Problem.	No Problem.	Space scarcity problem varies with the type of sub-loop unbundling required.
Lack of Willingness of the Incumbent to cooperate, disregarding rental rate regulation problems.	High, since both services revenues (voice and broadband) are passed to entrants.	Lower than Full LLU, since voice service is kept with the incumbent. In emerging broadband markets, first and second –mover advantages abound and the difference with Full LLU may not be so deep.	Lower than Line-Sharing, since the incumbent is able to provide voice and his own broadband service. Market considerations commented in line-sharing apply.	Equal to bit-stream.	Depends on the relative efficiency of the entrant's technology deployed in the sub-loop option.
Value of the New Competition	High in both voice and broadband markets, being only surpassed by facility-based entry.	High in broadband and none in voice, precisely where market power is always more pervasive.	Lower in broadband than in line-sharing. Descending value from options 1 to 3 of Figure 3.	Practically none.	Depend on the technology deployed by the entrant.

It is important not to overestimate implementation problems in unbundling. According to the OCDE (2003), "*all these technical problems should not be fundamental enough for incumbents to be serious sources of failure in switching lines for unbundling. Problems arising in practical implementation may be resolved by negotiating appropriate contracts. Above all, technical implementation problems are no more serious than in the case of interconnection. Thus, as long as regulators in a given country were already able to handle interconnection contract problems, LLU complexities can be, at least theoretically handled more easily*". In other words, there are no intrinsic complexities in the contract, beyond those that can be raised through the lack of willingness of the incumbent to cooperate.

This idea that unbundling implementation is no more difficult than interconnection is challenged by Epstein (2004), who defends that the regulator should limit itself to the latter task rather than the former. According to the author "*the need to establish interconnection is not a trivial task, but is comparable to joining together the different elements of the spinnal column. The sale of UNEs in contrast is a task comparable in difficulty to cutting up different nerves of the spinnal cord into small segments and then putting them back together again*". As noted by Justice Breyer, quoted by the author, in the first judicial challenge against the FCC implementation procedures, this complexity also tended to increase as long as more technologically sophisticated network elements appear. Furthermore, the symmetry of interconnection policy between the incumbent and the entrant ease the application of that regulation compared to unbundling.

Implementation problems are softened with more light-handed regulation on rental charges. In the limit, not intervening on rental charges may eliminate a great part of these problems. However, if unbundling rental rate controls are too loose or even lifted, then unbundled entry and competition may occur at a level below the optimal level expected by the regulator.

5. Country Experiences

5.1 USA

History

The USA was the second country to adopt the unbundling policy through the Telecommunications Act of 1996. This Act defines two standards to be fulfilled for a network element to be eligible for unbundling regulation. According to section 251(d)(2) of the act, "*the commission shall consider, at a minimum, whether - (A)access to such network elements as are proprietary in nature is necessary;"* **Necessity Standard** and **"***(B) the failure to provide access to such network elements would impair the ability of the telecommunications carrier seeking access to provide the services that it seeks to offer.*" (**Impairment Standard)**

A first reading of these two standards could indicate an "essential facility" approach for unbundling as proposed by Justice Scalia in a separate opinion in AT&T v. Iowa Utilities Board as quoted by Hausman and Sidak (1999). However, these standards, including the underlined expression "at a minimum", as commented by Nuechterlein and Weiser (2005, p.82), provided the Federal Communications Commission (FCC) with a substantive discretion to extend excessively the scope of the policy in favor of entrants.

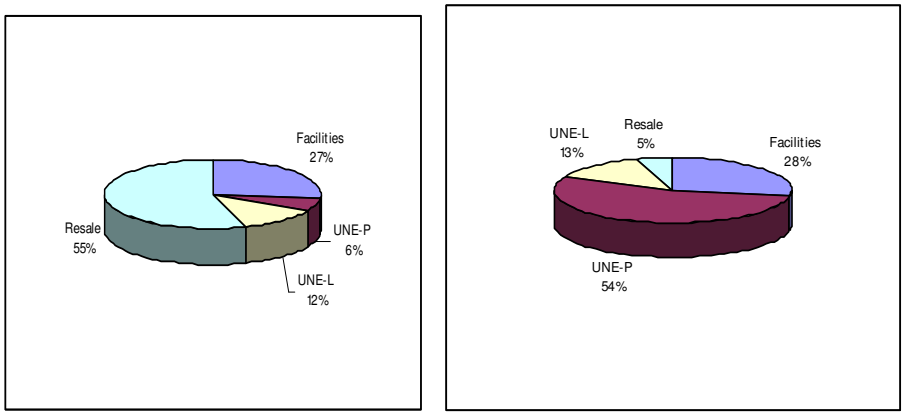
The interpretation of "necessary", for instance, was established by the FCC as "*any technically feasible unbundling*". Indeed, it is far from clear why necessity implies feasibility or vice-versa. Also, "impairment" for the FCC would mean that the quality of the entrant's service is not as good, even slightly, as when using the ILEC network element, and/or the cost of providing the service is higher, even slightly, compared to the case that the entrant uses the ILEC's element. This misrepresents the purpose of US legislators, who were, according to Hausman and Sidak (1999), concerned with "*consumer welfare and competition rather than competitor welfare*".

The initial minimum set of network elements mandated to be unbundled by the FCC after the act were seven: 1) Local loops; 2)Local and tandem switches; 3) Interoffice transmission facilities; 4) Network interface devices; 5)Signaling and call-related database facilities; 6)Operations support system functions and 7)Operator directory[48][49].

One of the key practical extensions of these standards was the creation of the Unbundling Network Element – Platform -UNE-P- concept in 1996, as developed in section II. Even UNE-P being a "pure resale" in practice, the FCC treated both arrangements differently, providing cheaper rates to the former. It is not surprising the dramatic substitution of UNE-P for resale arrangements between 1999 and 2004 as can be seen in the next charts.

Table II – Entry Modalities in the US (1999/2004)

December 1999 June 2004



Source: PACE Coalition . UNE-P Fact Report February, 2005

Indeed, UNE-P lines have grown from 0,5 million to 17,1 million in June, 2004, more than 34 times[50]. According to Hausman and Sidak (1999), the consequences of this pro-UNE-P policy was to attract firms that could have made a facility-based entry and/or were inefficient.

[48] The definition of a "network element" within this setting, however, could go even further. As commented by Nuechterlein and Weiser (2005, p.81), "*the FCC went one step further and until recently permitted competitors to lease, as "network elements", not just fixed increments of capacity, but variable (per-minute) increments as well*".

[49] Notice that in Japan, the essential facility rationale is explicitly quoted as a necessary condition for unbundling, but the network elements quoted as eligible are very close to the US.

[50] In view of the new regulations of the FCC (see below), this number has dropped to 16,6 million in December, 2004.

The loose interpretation of the unbundling provisions in the telecom act of 1996 resulted in the US Supreme Court challenging the implementation of the policy in AT&T v. Iowa Utilities Board in 1998. The main relevant issue was that the Court found that the FCC acted unlawfully when assumed that any increase in cost or decrease on quality would represent an impairment of the entrant. Another key issue was that the FCC ignored the role of other facility-based competitors, as cable companies, in a given geographic market as relevant information to enforce mandatory unbundling, failing to make a cost-benefit analysis. The court indicated that FCC's analysis should be more "granular", considering the specific features of each geographical area in the country.

In 1999, the FCC lifted the requirement to unbundle operator and directory services, but included line-sharing, sub-loop and the "dark-fiber" (fiber optic lines) as possibilities of unbundling, intending to assure competition in the emerging broadband market in the US. These extensions were taken as deepening the loose interpretations from the FCC of the US Telecom Act of 1996[51] and the judicial battle continued with another challenge on unbundling policy implementation in 2002 by the D.C Circuit[52]. Anyway, differently of the EU approach, bit-stream was not adopted in the US.

The Triennial Review Order of the FCC in 2003 was supposed to deal with those important issues. On one side, the FCC standard got a little closer to antitrust policies by considering that impairment existed when barriers to entry could make "*entry uneconomic*". At the same time, the FCC phased-out line-sharing for three years and removed the application of unbundling on facilities emerging from new investments on fibre-to-the-home loops and hybrid-loops[53] unbundling[54]. The main motivations were 1) the increasing broadband competition, including through alternative operators like cable[55]; 2) the growing consensus about the negative effects of unbundling on investment coupled with its impact on a key sector for development as broadband communications.

[51] See Hausman and Sidak (1999) and Nuechterlein and Weiser (2005) for a detailed discussion.
[52] See Nuechterlein and Weiser (2005) for a detailed discussion.
[53] Loops with copper and fibre.
[54] There was a fierce dispute on lifting "line-sharing", with the FCC's chairman struggling for the maintenance of the arrangement. See Powell Statement in FCC (2003).
[55] As quoted by Hausman and Sidak (2004), the Bernstein Research expects that cable companies will have acquired by 2008 about 15,5% of the consumer primary fixed access in the US, which extends this competition not only to broadband, but also to voice.

On the other hand, the FCC, in practice, kept UNE-P for conventional copper-wire voice service, providing poor further guidance to the "impairment standard", at the same time that transferred to the Public Utility Commissions (PUCs) the final application of the concept "*on a granular basis, whether economic and operational impairment exists in a particular market*". As remarked by Nuechterlein and Weiser (2005, p.103), since PUCs were strongly committed to UNE-P, this transfer would represent an indefinite prorogation of the policy with an even looser application of the "impairment standard".

In view of the clear contradictions of the new FCC policy, in June, 2004, this position was reversed by the U.S. Court of Appeals for the D.C. Circuit, withdrawing the delegation over the "impairment standard decision" to the PUCs and removing switching from the list of elements subject to unbundling, although maintaining UNE-P in some areas for a while. In February 2005, the FCC confirmed the removal of switching and "dark fiber" in the business market, from the unbundling policy beyond prohibiting the use of UNEs for the exclusive provision of long-distance (which may be particularly relevant to the main users of UNE-P, AT&T and MCI)[56] and mobile wireless telecommunications services. As quoted by Bauer (2005), the FCC also added that the "impairment" condition should be applied only when the entrant is considered a "hypothetical reasonably efficient competitor".

The removal of the "switching" function from the list of unbundled eligible elements can be considered a decisive step towards a less comprehensive unbundling policy in the US. As claimed by Chairman Powell at his statement in the FCC's 2003 nebulous decision, the switch "*is the brains of one's network and to be without one is to be a competitor on life support fed by a hostile host. Facilities-based competitors own more of their network and can control more of their costs, thereby offering consumers real potential for lower prices*". Hausman and Sidak (1999) already pointed out that switches should not be unbundled in view of at least three reasons. First, they were already competitive supplied: "*As of March 1999, one-third of all RBOC and GTE rate centers in the US were served by at least one CLEC voice switch, and eighteen percent were served*

[56] Gabelmann (2001) had already stressed that long distance competition requires only standard interconnection at the trunk side to guarantee competition in the service.

by at least two CLEC switches". Second, they are substitutable across areas, not being sunk costs. Third, they are replicable.

According to Bauer (2005), these changes may have provided the incentives for the acceleration of DSL and fiber rollout by the incumbents in the US.

Finally, by August, 2005, the FCC ordered that all wireline broadband Internet access providers be considered information service providers and released by the requirement to unbundle the transmission component of their Internet access service. The purpose of the order was explicitly to "leveling the playing field"[57] between cable providers and conventional telephone companies (with xDSL) in the broadband market, an old and reasonable claim of incumbent telecom operators.

A particular feature of the unbundling policy in the US is that an adequate provision of this service became one of the requirements[58] to allow the ILECs entry in the long distance service. In one hand, this can turn ILECs more cooperative in unbundling than otherwise, handling the contract incompleteness problem[59]. On the other hand, as pointed by Spiller and Ulset (2003), since long distance operators like the AT&T would not like to have the ILECs competing in the long distance service, these companies would be less willing to request unbundling in the local service from the ILECs. Since the main US long-distance providers, AT&T and Worldcom, accounted, by August, 2002, for about 57% of all UNE-P lines, this regulatory and artificial lack of incentive to request unbundling may have reduced the scope of the policy.

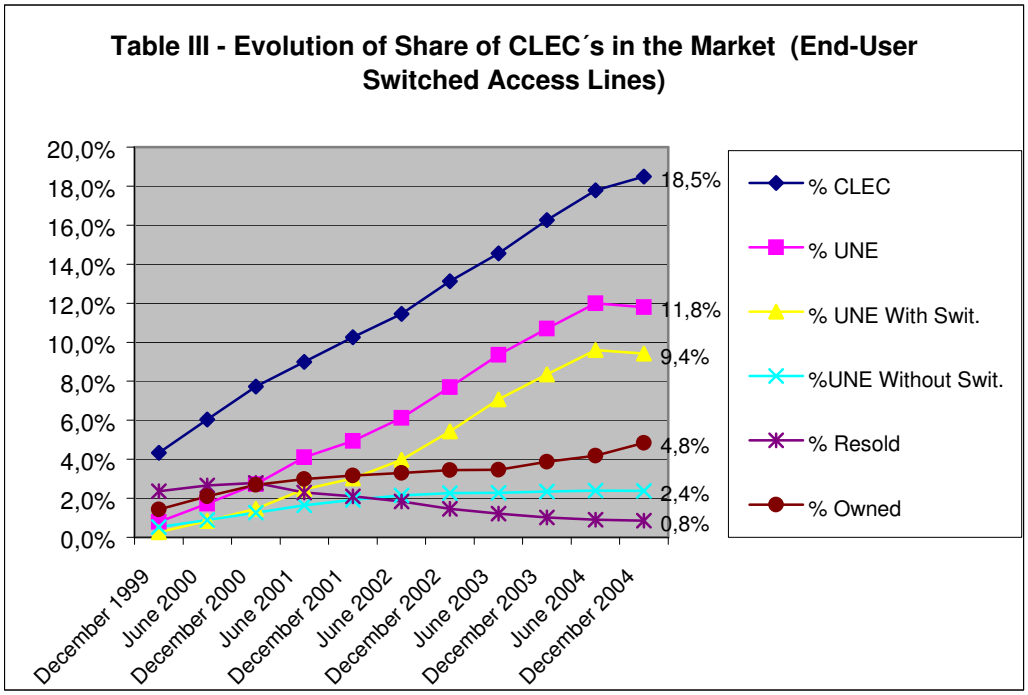
Bauer (2005) supports the unbundling de-regulation in the US on the basis of a likely reduction of litigation in the sector: "*if the new framework avoids further court challenges it should reduce regulatory uncertainty that has plagued investors during the past decade and probably depressed investment levels. Overall, given the changing industry conditions and the necessity to compromise, at the end of the long struggle, the view seems to have prevailed that the potential negative effects of higher prices for*

[57] In Chairman Kevin Martin's own words.
[58] This also holds true for the requirement of interconnection, which induced excessive litigation from the long distance operators without real interest to interconnect and/or enter the local service as argued by Spiller (1997).
[59] Frieden (2005) proposes that this sort of liberalization and relaxed regulatory oversight be exchanged for unbundling cooperation in general.

unbundled access and possibly retail services pale compared to the benefits from stronger investment incentives, the long-term benefits of more robust facilities-based competition, and increased regulatory certainty……The US unbundling framework had been very tedious and intrusive; the past eight years also illustrate that in an environment with increasing competition such detailed regulatory rules are not sustainable".

US Market Developments

Market competition in fixed line telephony, measured by the CLECs market-share in end-user switched access lines, is continuously increasing in the US as can be seen in the data from the FCC report of July 2005. From a 4,3% figure at December, 1999, the CLECs market-share raised to 18,5% five years later.



Although the number of all types of CLEC´s lines, resold, unbundled (UNE with and without switching) and own lines (facility-based) have increased steadily since 1999, the data shows that the increase on entrant´s market-share was accompanied by a relative increase on the share of UNE lines, which reached 11,8% of total lines at December, 2004 (representing 57,7% of total CLECs lines). This relative increase of UNE lines was obtained at the expense of a relative decrease on resold lines (2,4% to 0,8%) and on a

possible smaller increase on facility-based CLEC´s lines. Clearly, UNE growth replaced strongly the growth of the resold lines in view of the price advantages of a UNE-P entry, mentioned above, but a crowding-out with facility-based CLEC´s growth cannot be disregarded at all. Even with an increase of CLEC´s facility-based lines in total lines from 1,4% to 4,8%, there was a relative decrease of 7 percentage points of the share of this modality on total CLEC lines, which may be due to the very intense growth of UNE.

The role of UNE-P in the overall UNE strategy can be seen in the robust growth of UNE with switching (from 0,3% to 9,3% of total lines) relative to the more modest growth of UNE without switching (from 0,5% to 2,4% of total lines).

It is also important to remark the relative growth of coaxial cable technology in total CLEC´s lines, which grew steadily from 3,8% at December, 1999 to 12,4% at December, 2002, a movement that was partially reversed in the two following years, reaching 11,3% at December, 2004. The relative growth of coaxial cable technology was much stronger in the broadband market. From 44,1% of total broadband market in 1999, the share of coaxial cable jumped to 72,4% at December, 2004. ADSL´s share also increased, but at a more modest pace, from 9,4% to 19,7%. Fiber, powerline and other wireline technologies shares have dropped accordingly in a market that increased more than 14 times in the period.

Crandall, Sidak and Singer (2002) had already pointed that in the US, cable and DSL were in the same relevant market, with prices moving together. Joining this fact with the existence of strong cable companies as AOL Time Warner, AT&T Broadband, Comcast and Cox Communications and its widespread penetration in the US territory with unused capacity[60], the high own demand elasticity of DSL (-1,184 as calculated by the authors and -1,462 as calculated by Rappoport, Kridel, Taylor and Duffy-Demo (2001)), the significative cross-price elasticity of demand of cable (DSL) in relation to DSL (cable) price, which amounted to 0,59 (0,41), cost and technological advantages on broadband service by cable companies compared to DSL and, finally, the softer regulation of cable compared to telephone and the lack of any dependence of cable companies to ILECs, made asymmetric regulation between ILECs and cable undesirable in the broadband market.

[60] The authors estimated that the excess capacity of cable companies for broadband delivery would be about 86% by 2003.

Moreover, the FCC believed at that time that the most promising technologies to enhance broadband penetration in the future were satellite and wireless, and not xDSL or cable. Indeed, the US is the OCDE country where the share of cable technology in broadband deployment is the highest (around 55%).

In sum, the US unbundling policies shows two distinct stages. The first one occurred between 1996 and 1999. In 1996, after being launched in the Telecom Act of 1996, FCC's generous treatment of entrants focused the voice market. In 1999, the focus changed to broadband since the FCC realized that the emerging broadband sector could be boosted through extending the unbundling policy to xDSL and fiber. After a transition between 2000 and 2002, the US unbundling policy entered the second stage in 2003 with attempts to "reverse" the scope of the policy, mainly focused on the broadband market. In the end, the D.C Circuit took the lead on starting a serious phasing-out of UNE-P.

5.2 Europe

5.2.1 General Features

The European Commission (EC) issued Regulation N 2887/2000 at 18 December 2000, mandating unbundling with collocation for players who have been designated by their respective national regulatory authorities (NRA) as having significant market power (SMP) in the fixed public telephone market.

The 6th Implementation Report (2000) of the EU affirmed that Full LLU was already operational, to a greater or lesser extent, in Denmark, Germany, the Netherlands, Austria, Finland and Sweden[61]. NRAs from the UK, France and Italy had also mandated Full LLU and trials on its implementation were also occurring by this time. In the UK, in particular, the regulator had reversed an anti unbundling statement of 1996 and by December of 1998, declared that this policy had become a necessary condition to foster broadband penetration. In Italy, unbundling covered copper and fibre since the beginning.

[61] For a summary of the history of unbundling in Europe, see also De Bijl and Peitz (2005).

Bit-stream access was also offered in Denmark, Germany, Spain, Italy[62], Austria, Finland, Sweden and the UK. Line-sharing was not operational in any member-state at this time.

Although keen to encourage free-negotiations on unbundling, the EC recognizes, in view of the former experience, that regulatory intervention was necessary and implemented a strong formal intervention in unbundling policy. To assure that deliberate delays would be minimized, the EC mandated that the SMP operator published an adequate Reference Offer for Unbundled access to the local loop (RUO) as soon as possible under the supervisory control of the NRAs. To minimize misunderstandings and deliberate delays on LLU implementation, Regulation nº 2887/2000 contained a minimum list of items to be included in the RUOs throughout Europe, including elements to be offered, technical characteristics of the local loop, collocation practices, pricing, among others. NRAs are supposed to be able to change RUOs, design an "*a priori*" price methodology or even set regulated cost oriented prices.

The EC did not open so widely the set of network elements to be included in the unbundling package of conventional voice telephony, focusing the local loop. However, notice that this is not an absolute statement since 1)the EC minimum RUO requirement list includes the "operator's operational support systems" as part of the offer and; 2) the possibility of "virtual collocation" established in the RUO list and also adopted by many EU countries can also represent an implicit means of "enlarging" the number of elements to be unbundled. This is because "virtual" means, in practice, use of the incumbent's network elements.

The EC is able to act like a "benchmarking regulator", providing to all NRAs, information on best practices about LLU contracting and enforcement in other NRAs and promoting information exchange[63]. Thus, through the quick action of the EC, each NRA "learning by doing" process is supposed to create positive externalities to others.

[62] See Gallo and Pontarollo (2004) for the history of unbundling in Italy, including the disputes and delays on implementation.
[63] This function overlaps part of the work of private lead institutions like the International Telecommunications Union-ITU.

Telecom Competition in the EU

The set of policies designed to foster competition in telecommunications market in Europe seems to be working, if we consider the continuous decline in the incumbent market share and the increase in the number of new entrants as shown in the 11th European Implementation Report (2006, p.13/15). The average market share of the incumbent in local calls, long distance national and international calls, respectively, fell from 86,5%, 74,2% and 66,2% in 2000 to 67,3%, 65% and 54,9% in 2005.

The country with the smallest incumbent's market-share in local calls is Austria with 51%. Several countries, however, remain with the incumbent holding over 90% of local market-share as is the case of Denmark, Greece, Ireland, Portugal and Finland, besides most of the newcomers of the block. In Finland, Sweden, Austria, Germany and the Netherlands, the market for international calls was already considered competitive by the respective NRAs. For five countries, the non-residential voice markets were also deemed as competitive. However, the 11th Implementation Report considers that for local and long distance national markets, the prospects for full-blown competition remains low.

The figures for the fixed broadband market competition is more benign than for voice with an entrant´s average market-share of 50% by the end of 2005 and increasing. The country with the smallest incumbent's fixed broadband market-share is the UK, with 25%. Around 80% of the fixed broadband supply in Europe is provided through DSL lines, which is one important element about the importance of LLU as a means to foster competition in the broadband market in Europe. Anyway, the 11th Implementation Report (2006, p.34) stresses that the relative importance of Wireless local Loop (WLL) and Fiber to the Home (FTTH) is increasing.

Some EU countries count with DSL to provide more than 90% of the fixed broadband market as Greece, France, Italy, Cyprus and Germany (97%)[64]. In these countries, lack of inter-platform competition may make unbundling a more valuable

[64] See the Cocom Report (June, 2005).

alternative to foster broadband competition. On the other hand, 16 out of 26 countries count with alternative fixed broadband providers with 30% or more of this segment.

The most pronounced difference in the fall on the incumbent's share of DSL lines (21,9 percentage points) compared to general broadband (9,3 percentage points) is an indicative for the EC that "*the competitive dynamic is more marked for the DSL markets than for the cable markets*". Moreover, DSL lines grew in 2004 six times faster than cable.

Anyway, the 11th Implementation Report (2006, p.6) stresses that the EU countries with the highest broadband penetration count with both, high cable penetration and well developed unbundling regimes.

Competition Through Unbundling in Europe

An overview of unbundling penetration per country in Europe, based on European Competitive Telecommunications Association - ECTA - data for July 2005, is provided in the table below.

Table IV - Full LLU, Line-sharing, Bitstream and Resale in Europe (as a % of total Incumbent Copper Subscriber Lines) July-2005

	Resale %	*Bit-Stream %*	*Full LLU %*	*Line-Sharing %*	*Sum %*
Austria	0,00%	3,45%	3,39%	0,00%	6,84%
Belgium	0,00%	7,05%	0,19%	0,06%	7,30%
Czech Rep.	0,00%	0,00%	1,11%	0,00%	1,11%
Denmark	0,63%	3,79%	2,83%	2,70%	9,95%
Estonia	0,00%	0,00%	0,83%	0,00%	0,83%
Finland	0,00%	2,51%	6,63%	1,53%	10,67%
France	0,00%	5,42%	0,76%	6,20%	12,38%
Germany	1,89%	0,00%	7,91%	0,01%	9,81%
Greece	0,81%	0,00%	0,07%	0,03%	0,91%
Hungary	0,00%	2,98%	0,00%	0,00%	2,98%
Ireland	0,00%	2,00%	0,05%	0,09%	2,14%

Italy	0,00%	3,30%	4,57%	0,37%	8,24%
Latvia	0,01%	0,03%	0,00%	0,00%	0,04%
Lithuania	0,00%	0,37%	0,00%	0,00%	0,37%
Luxembourg	0,00%	1,95%	1,13%	0,02%	3,10%
Malta	6,60%	0,00%	0,00%	0,00%	6,60%
Netherlands	0,00%	0,00%	0,85%	7,29%	8,14%
Poland	0,00%	0,00%	0,00%	0,00%	0,00%
Portugal	0,00%	1,38%	0,85%	0,00%	2,23%
Slovakia	0,00%	0,00%	0,00%	0,00%	0,00%
Slovenia	0,03%	0,22%	0,00%	0,00%	0,25%
Spain	2,39%	2,19%	0,71%	1,01%	6,30%
Sweden	2,55%	0,06%	0,71%	4,81%	8,13%
UK	0,00%	13,69%	0,13%	0,13%	13,95%
Average	0,69%	3,81%	2,59%	1,70%	8,79%

Source: European Competitive Telecommunications Association – ECTA – July, 2005

The European countries where full LLU is more advanced are Finland (6,6%) and Germany (7,9%), followed by Italy (4,6%) and Austria (3,4%). Netherlands is more focused on line-sharing (7,3%) jointly to France (6,2%) and Sweden (4,8%). By far, the UK holds the most important position relative to bit-stream, which represents 13,9% of all incumbent´s copper lines. This country holds the highest level of unbundling, considering the four modalities. Resale is relevant in Malta (6,6%), followed by Sweden (2,5%) and Spain (2,4%).

The Cocom Report of June 2005 indicates that, in the margin, the already greater number of DSL lines is also growing faster than the deployment of alternative broadband technologies. In 2004, broadband lines increased 70.26% (a little bit less than the 86% growth reported in 2003), being a 86% growth of DSL lines compared to a figure of only 14% growth for the new broadband connections using other technologies. Assuming that the bulk of the DSL new connections are incumbent's, this figure indicates that the degree of network dependence on the incumbent´s infrastructure is growing in Europe.

Current Strategy of the EU on Unbundling

As the EC started its unbundling policy later, it became naturally more focused on the broadband market rather than in the voice market if compared to the US. The promise of broadband on boosting the emergency of the "information society' and its expected impact on the competitiveness of the block lead the way since the very beginning of the unbundling policy in the EU. Notice, however, that the focus of the EC on broadband, mainly considering its recent emphasis on bit-stream and line-sharing, does not imply that the voice market is not impacted. As stressed by De Bijl and Peitz (2005, p.35), the growing use of VOIP are blurring the separation of broadband and telephone markets. So, policies that help to increase the penetration of the broadband segment may also improve the penetration of the voice segment.

The EC confers high importance to the mediating role of resale and bitstream entry (mainly this last one) as a means for the entrants to get able to provide broadband services through LLU and line-sharing and then facility-based competition through the "ladder of investment" approach commented above.

The EC in the Broadband Market Competition Report-(May, 2005) works heavily with this concept. According to the EC "*investments are made in a step by step way by new entrants. In order to allow new entrants to gradually (incrementally) invest in own infrastructure they need a chain of (complementary) access products to acquire a customer base by offering their own services to end users based on (mandated) wholesale access. Once they have gained a critical mass generating revenues to finance the investment, they will deploy their own infrastructure taking them progressively closer to the customer and increasingly able to differentiate their service from that of the incumbent, also making them less dependent of the incumbent's infrastructure. This involves migration from one access product (or access point) to another (moving to the next rung). Once the process gets started and provided the right regulatory measures are taken, the process will get its own dynamic and with the different elements reinforcing each other will become self-propelling. Thus a sequential approach should start with making the resale option available.....Countries like Germany where not all access products are available (yet) and*

which started in reverse order (with the unbundled local loop) have less competitive DSL markets and a lower penetration as market entry required more initial investment by new entrants. The recent development in France, Italy, and the UK seems to suggest that the process gains additional momentum once a certain threshold is passed".

The EC stresses that the "ladder of investment" concept is supported by the empirical evidence for Europe as presented in the Broadband Report (May, 2005): "*While at the beginning most new entrants relied on resale, bitstream access has taken over resale as the preferred form of access and is now the wholesale access product mostly used (with a share of more than 1/3 compared to a resale share of below 30%)….this suggests that migration from resale to bitstream is taking place….the number of shared access lines has also increased (highest increase of all access forms) as has full unbundling…this suggests that the ladder of investment exists, new entrants are starting to climb up the ladder and a move from service-based to network-based competition can be observed. The conclusion of this rationale is that "competition is (mainly) driven by access regulation and is access-based (intramodal platforms) rather than inter-modal (facility-based / alternative infrastructures)….although competition from cable operators can be observed particularly in the Netherlands, Austria, Estonia, Malta, Switzerland, Spain, and the UK…however, the existence of several infrastructures (DSL / cable) does not automatical mean they are "competing"…the more complete the chain of access products is (and the more complementary the options are a new entrant can choose from), the higher the competitive dynamic…thus differences in the effectiveness of access regulation explain differences in competition and accordingly in penetration growth.*"

The importance of the "ladder of investment" approach is still mentioned in the 11th Implementation Report (2006, p.9), but with less emphasis than in the previous Reports. This may have been caused by the emergence of a strong demand in the wholesale market of triple-play, which requires a more complete unbundling modality through LLU.

The EC explicitly contrasts its model based on the ladder of investment to the (new) "American model" of unbundling, in which it is assumed that the mere existence of alternative infrastructures will lead – more or less – automatically to competition and thus considers unbundling regulation not decisive. The European "ladder of investment"

approach, according to the Report, would explain the relative European recent success in developing broadband markets[65].

The regulator is responsible to assure incumbent compliance to the policy, which can be dampened by the complexity of the arrangements. According to the EC in its 10th Implementation report "*the positive development of investment by new entrants and the migration of customers to better-grade products via a move from resale products to bit-stream and local loop unbundling may in some cases be frustrated by process related problems. As a result, developments for example relating to rollout of local loop unbundling are patchy across the Member States*." In this context, the EC (2004) informs that "*since the 2nd half of 2002, the focus shifted away from unbundled and shared access as mandated by Regulation nº 2887/2000 to bit-stream access*".

This change of focus is revealed in the data from the ECTA data for the third quarter of 2005. The bit-stream access modality prevails responding for almost half (48%) of the total unbundled entry in Europe, followed by line-sharing (21%), Full LLU (20%) and resale (11%)[66]. There was also an impressive increase on bit-stream access compared to the other modalities, especially Full LLU. While at July, 2003, the number of Full LLU and bit-stream basically matched in Europe, in July, 2004, the last modality reached more than the double of the Full LLU, even overtaking the number of resale lines, the most used modality until January, 2004.

The European Commission stresses that *"there was a slight decline on the share of bit-stream and resale lines in total entrant's DSL lines from 73% in July 2003 to 67% in July, 2004*" at the same time that the "*full LLU and line-sharing arrangements have grown faster (197%) compared to the other two modalities*". According to the EC, this "*suggests that competition is moving from service-based products to network-based competition*".

However, this is a quite strong conclusion to be taken from the numbers. The outstanding growth of the sum of Full LLU and line sharing is clearly caused by the low initial level of line sharing in July, 2003 and its marked growth afterwards, surpassing the

[65] Indeed, by the OCDE (2005) calculation, the US lags behind most European countries in broadband penetration. The US holds the 13º position in the ranking.
[66] Notice that, as stated by Bourreau and Dogan (2004,p. 289), resale is not compulsory in Europe as it is in the US.

number of Full LLU lines. In this context, we can also read these numbers in the other way: Bit-stream and line sharing grew relatively much more than Full LLU, which means that competition is, in another sense, also moving from network-based competition to service-based competition. The smaller growth of the "other broadband alternatives", such as cable, quoted before, also indicates less network-based competition.

The main point here is that the relative growth of bit-stream and line-sharing compared to pure resale does not mean that there is more network competition in the broadband service, since the growth of Full LLU and new facility-based competition is not that high. The new possibilities for bit-stream and line-sharing access open in Europe since 2002 may have crowded-out part of the "pure resale" growth by improving the scope for competition by differentiation (upgrading the level of network competition) as well as part of the growth of Full LLU and alternative network growth (downgrading the level of network competition). The process may have stuck at one of the bit-stream levels, a result that may not be desired for the purpose of long-run competition in the sector.

The 11th Implementation Report points that this upgrading continues with line-sharing having tripled in 2005, mainly in the UK, France and Denmark. The preference of entrants for triple-play also responds for the increase on the demand for this modality since the voice service can be provided through VOIP in line-sharing.

The EC stresses that the growth in unbundling in 2004 contrasts to disappointing results, particularly for broadband purposes, until 2003. According to the Commission, "*a combination of complexity, in terms of product and process development and dispute resolution, as well as unattractive wholesale prices, had halted progress*". The Commission points out that the improved performance in 2004 resulted from the fact "*that appropriate regulatory action has been taken in a number of Member States*". If this last explanation holds true, it is possible that the NRAs of most European countries started to harvest the fruits of the difficult "learning by doing" process involved in enforcing unbundling, overcoming the implementation problems raised in section III.

LLU Pricing in Europe

We cannot neglect the role of a factor stressed by the EC, but not pointed by this body as an explaining factor for the "unbundling uptake" in Europe, that is the regulatory pressure over unbundling pricing. For most of the EU countries, the average charges for Full LLU and line-sharing charges have been dropped between 2002 and 2005, by 23,4% and 42,7%, respectively.

Furthermore, De Bijl and Peitz (2005) report that the practice of price squeezing in unbundling by the incumbents in Europe, a strong source of conflicts in the early days of this policy is becoming less common.

Institutional Issues and Unbundling Disputes in the EU

The EC at its 6th Implementation Report already noticed that "*in countries where Full LLU is already offered or imminent, conditions for collocation, in particular, delays in responding by the incumbent operator, are in some cases creating problems for new entrants, calling the attention of the NRAs for close monitoring*".

One year later, at the 7th Implementation Report in December, 2001, the EC observed that, although Full LLU agreements had already been concluded in ten member states, the implementation of the policy "*has been very disappointing……and should be speeded up on the basis of hands-on monitoring by NRAs, binding deadlines and credible penalties*", beyond assuring that "*wholesale DSL is offered to entrants on non-discriminatory terms*". Shared access was actually operational only in Belgium, Denmark, Finland and Sweden, with a very limited number of lines. The EC showed concern on several problems of unbundling enforcement by the NRAs, including lack of power to enforce remedies and lack of skills to resolve disputes rapidly, systematic appealing against NRA decisions coupled with lengthy and cumbersome appeal procedures, operational difficulties in collocation and difficulties relating to regulated pricing.

Delaying unbundling implementation was taken by the EC as a means for incumbents to get a first-mover advantage in the emergent broadband market, which

should demand careful attention of the NRAs. That's why the EC supported the Italian and French policies of not allowing the incumbent to launch its own DSL service, after a wholesale offer to other competitors was already done, even at the cost of delaying greater broadband penetration in the country[67].

The same institutional concerns of the 6th Report in December, 2000, remained at the 11th Implementation Report in February, 2006, which demonstrates the relevance of the analysis of section III.

An interesting initiative has been taken in the United Kingdom by the NRA, OFCOM, with the establishment of the post of "Telecoms Adjudicator" to help resolving disputes relating to local loop unbundling[68]. This suggests that the institutional dimension is key for this sort of policy.

5.3 Other Countries

Mandatory unbundling in Australia started at July, 1999. Its results were deemed as disappointing by the regulator, the Australian Competition and Consumer Commission (ACCC), at December 2004, in view of the few numbers and the high concentration in the business market, with low penetration in the most relevant target of the residential market. The reasons for frustration in LLU policy reside in both, price squeeze practices and operational problems caused by lack of willingness of the incumbent to cooperate, once more consistent with section III.

ACCC's general approach is to encourage parties to set out the terms and conditions without excessive regulatory intervention. However, ACCC has been, in practice, quite active to intervene in LLU arrangements. The regulator challenged the first proposed rental charges and issued, in April 2002, final LLU prices and basic pricing principles. Even after this first intervention, ACCC remains monitoring potential price squeeze practices. ACCC applied in 2004, an imputation test which requires large

[67] The UK, Australia and Japan also followed the same policy.
[68] In Japan, there is also the "Telecommunications Business Settlement Commission", a body charged with realizing fair and effective competition in the telecommunications business sector as well as to provide quick and smooth dispute settlements.

incumbent carriers to demonstrate that the revenues from a retail service will equal or exceed the sum of the costs of the services. Telstra failed the imputation test on the LLU by over 200 per cent.

ACCC (2005) considered that in 2002–04, the positive effects of unbundling slowed, stressing that the benefits of competition and even its sustainability "*will only be likely if there is an increase in competition further up the value chain in facilities or quasi facilities-based markets*".

According to the ACCC (2005), it has powers to enforce non-discriminatory supply and to arbitrate disputes. However, these powers "*rely on ex post monitoring and enforcement through the Federal Court or potentially lengthy arbitration processes*". The main difficulty in using this system is the lack of an objective standard to prove discrimination, since Telstra does not supply the service to itself. Thus, according to the regulator, "*court enforcement requires that there be a reasonable amount of discrimination before it is cost-effective to litigate*". Moreover, the ACCC also stresses that *"in some cases not even the access seekers will be aware that they are not being offered the appropriate service; and the time spent litigating may do serious damage to the business case for LLU uptake"*. This suggests that the regulator identified both problems of observability and verifiability of LLU contract provisions in the Australian context.

In New Zealand, as pointed by Hausman and Sidak (2004), the Commerce Commission issued a report by December, 2003 recommending only bit-stream for ADSL to residential markets and small and medium companies. The cost-benefit analysis proceeded by the Commission concluded that the regulatory cost of unbundling, a public resources intensive activity, would not worth the benefits. In particular, the Commission deemed that inter-platform competition would be enough to curtail prices.

Korea is the country with the highest broadband penetration in the world and where there was no formal unbundling policy until 2003. So, this would be an example that unbundling is not a necessary condition for high broadband penetration rates. The motivation for introducing this policy quite recently, according to Crandall (2005, p.183), was the necessity to increase competition in narrowband and not broadband service.

Hong Kong was the first country to adopt unbundling in 1985, extending it to broadband between 2000 and 2003. According to Crandall (2005, p.184), however, this reduced the stimulus of local cable companies to invest in broadband infrastructure. In view of this, the regulator announced in 2004 the phasing-out of the policy.

Crandall (2005, p.183), usually skeptical about this policy, recognizes that unbundling in Japan, introduced in 2000, "*may prove to be a great success*", which derives from the aggressive pricing policy undertaken by the main beneficiary of the incumbent´s NTT, leased lines, "Yahoo! BB". However, the author argues that the huge losses incurred by this company may also suggest that the company´s strategy will not be sustainable in the long run.

6. Conclusions

As we remarked in the international experience, the main two economic regions of the Western world, the US and the EU, are currently following two distinct views on the role of unbundling. As in the first stage of the US policy, the European Commission (EC) regards unbundling as an instrument to stimulate competition, mainly in the broadband market. On the other hand, the US seems currently to be more sensitive to the argument that unbundled-entry may crowd-out facility-based entry since it reduces the incentive for investment and innovation for both, the incumbent and the entrant. In the specific case of the broadband market, the current and expected competition stemming from other technologies as cable, wireless and satellite would also reduce the role of the conventional telephony infrastructure as a means to increase penetration and welfare.

Implementation problems, however, are pervasive. As argued by Epstein (2004), the main basic problem of unbundling is that "*forced associations do not work. One side has a subsidy from which it will not easily back off. Another receives a burden that it will take steps to remove. There is no front end goodwill to ease the blow, and no way for any outsider to discover which allegations of foul play are true or false*". Therefore, a comprehensive unbundling policy will fail or take a very long time until regulators learn by doing in this sort of intervention.

So, if unbundling is implemented, a parsimonious intervention should be the rule. In this sense, Hausman and Sidak (1999) proposed a standard of application of unbundling in five sequential steps that we think may be a suitable criteria for the regulator to decide about the enforcement of this policy: a) technical feasibility of unbundling; b) refusal of unbundling by the ILEC at a TELRIC regulated pricing; c) non-replicability; d) the requested network element is controlled by the ILEC; e) the ILEC can exercise market-power in the end-user market by restricting access to the element. Network elements with low fixed costs in geographically dense areas, for instance, should not be subject to mandatory unbundling. Notice that the fifth step is centered on the end-user and not in the competitor. This means that even if the entrant is not able to enter without unbundling that element, the policy will not be mandatory if the end-user has access to alternative operators as cable or wireless companies.

There are trade-offs to be dealt. Full LLU is more simple to enforce and offers a wide scope for service differentiation by the entrant. Competition in the voice market became possible in Line-Sharing with VOIP technologies. Bit-stream keeps the incumbent able to provide broadband market, but also makes regulation more cumbersome. Sunset clauses or an adequate sequence of increasing rental charges should be introduced to foster the ladder of investment. In any case, the use of unbundling may be parsimonious and temporary with regulators considering how the international experience may apply to local realities.

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