EU’s Positions on Net Neutrality: A Regulatory Perspective

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List of Abbreviations

ADSL: Asymmetric Digital Subscriber Line  
BEREC: Body of European Regulators for Electronic Communications  
CMT: Comision del Mercado de las Telecomunicaciones  
DSL: Digital Subscriber Line  
EC: European Commission  
ECS: Electronic Communication Service  
EU: European Union  
FCC: Federal Communications Commission  
ISP: Internet Service Provider  
LLU: Local Loop Unbundling  
NN: Network Neutrality  
NRA: National Regulatory Authorities  
Ofcom: Office of Communications  
SMP: Significant Market Power

Abstract

The broadband internet is a key sector for modern market economies. As such the management and development of the network is receiving a great deal of attention and gave rise to the “net neutrality” debate. Different views are establishing on both sides of the Atlantic on the extent to which independent regulation of the sector is needed. This paper reviews the existing economics literature to evaluate the implications of institutional and market settings characterizing the European economic areas. Several scenarios for the evolution of the EU market are identified considering the policy options that may be appropriate.
1. Introduction

The broadband technology is characterized by the high speed of delivery of data packets and in most cases it comes bundled with other services (i.e. telephone or cable TV). These features coupled with some engineering properties of the broadband technology allow network owners to discriminate content providers. This possibility has evoked a heated debate on Net Neutrality (NN) regulation as the unknown effects of such discrimination may call for a stringent, ad-hoc regulation. The lack of consensus on the meaning of NN, on the practical instruments and on the effects of regulation is reflected in different policy responses on the two sides of the Atlantic. This paper focuses on the industry in Europe and on the debate that has developed in the last few years over its regulation. I summarize the state of the debate in the European Union (EU) at date and evaluate them through the existing results in the economics literature. An analysis of the current institutional and market context leads to outline the possible future scenarios and the evaluation of possible policy instruments to be adopted by the EU competent authorities. The structure is as follows. Section 2 provides an overview of the NN debate in the EU. Section 3 identifies the most relevant economic issues for the debate and discusses the answers that theory provides. Section 4 reviews the structural and institutional conditions in the European broadband sectors. Section 5 analyses and evaluates the policy options available to the European regulator. Section 6 concludes.

2. An Overview of the NN Debate in the EU

The NN debate originated in the U.S. and has also become a heated topic recently in the EU. The European Commission (EC) has committed to take active actions to legislate on NN. The principles of the EU telecoms reform approved in November 2009 by the European Parliament seem to be the ban of unfair discrimination as abuse of dominant position, imposing a minimum quality standard of services and transparency over the possible restrictions imposed on the networks users. On 23 November 2009, the
EC released the declaration on NN added to the telecoms reform package. “The Commission attaches high importance to preserving the open and neutral character of the Internet, taking full account of the will of the co-legislators now to enshrine net neutrality as a policy objective and regulatory principle to be promoted by national regulatory authorities, alongside the strengthening of related transparency requirements and the creation of safeguard powers for national regulatory authorities to prevent the degradation of services and the hindering or slowing down of traffic over public networks”.¹

On 30 June 2010, a public consultation on “[t]he open internet and net neutrality in Europe” was launched by the EC. The report responding on the key issues raised by the consultation was published on 9 November 2010 and revealed that “[t]here appears to be consensus among network operators, internet service providers (ISPs) and infrastructure manufacturers that there are currently no problems with the openness of the internet and net neutrality in the EU”.² Later in the same year, in its response to the EC’s consultation, the recently created Body of European Regulators for Electronic Communications (BEREC)³ notes that “there have been cases where equal treatment of all data was not ensured”. Some of these cases may raise concerns for a competitive market.⁴ On 29 May 2012, BEREC published the results of its investigation into traffic management practices in Europe together with a series of publications for consultation on the topic of net neutrality.⁵ It finds that a wide array of traffic management practices are in operation and the majority of internet service providers (ISPs) are offering internet access with no application-


specific restriction, while an estimated 20% of mobile internet users in Europe experience some form of restriction on their ability to access VoIP services. Further on 27 November 2012, BEREC published a draft report on the public consultations on NN. 6

In the UK, NN seems to have finally caught on. The arguments have mostly been about how far ISPs should be allowed to go in throttling the BBC’s hugely popular iPlayer application. The rapidly increasing usage of the BBC’s iPlayer has ISPs complaining as at least one company has reported that traffic for streaming video has doubled since the BBC officially introduced the iPlayer in late December of 2007. Some UK ISPs called for the BBC to pay up as iPlayer takes up more of their customers’ total bandwidth consumption. Others want the regulator to step in. 7 In 2009, the BBC accused BT of “throttling” download speeds for its iPlayer service, while BT said that content providers should not expect a “free ride”. However, UK regulators do not appear concerned about NN. According to Ofcom, the UK’s telecoms regulator, there is currently no need to introduce NN legislation as they believe there is more access competition in the UK which means a regulator can let the market sort out the issue itself. These views were expressed by Ofcom in its Draft Annual Plan 2013/2014 published in December 2012 for consultation. 8

In Spain, in November 2009, the mobile operator Vodafone launched a new offer that violated the fundamental principle of NN. It announced that it would prioritize Internet access for its mobile subscribers who were ready to pay an extra fee when the 3G network was congested. 9 This means that instead of equally sharing the network capacity between all users, Vodafone will discriminate against the subscribers who do not pay the extra fee, and deliberately slow them down. Following that in February


7 This sounds like the beginning of the net neutrality debate in the US back in 2005, when AT&T wanted Google to pay for YouTube traffic.


9 This happened only a few weeks after the Dutch Internet service provider UPC decided to discriminate Internet traffic.
2010, Mr. Cesar Alierta, CEO of telecommunications and Internet service provider Telefonica, made the following statements: “It is evident that Internet search engines use our networks without paying us anything, which is good for them and a disgrace for us”…… “This cannot continue, we set up the networks (…) we do everything. This will change, I am sure”.

Then in a meeting at Bilbao, Spain, Cesar Alierta expressed that his company would charge Google and other search engines for the use of their network. However, Spanish telecommunications regulator CMT’s chairman, Reinaldo Rodriguez, expressed his views in April 2010 that there is no justification in forcing Google to share its revenues with Telefonica, adding his voice to the international debate over NN.¹⁰

Some other national authorities have also manifested their position. A remarkable case of breach of NN in Germany was when T-Mobile, the largest German mobile telecommunication company, announced on 2 April 2009 that it was blocking Skype. The Dutch parliament has adopted a resolution in which it calls for a neutral Internet. France has already begun its consultation and the French government is also studying the question, having commissioned a report on the subject in April 2010.

In addition, three cases recently hit the news as possible breaches of NN.

In February 2010, the lower house of the French parliament passed a bill that imposes major controls on Internet traffic, justifying these on the ground of security and control of digital crime. A similar law has also been proposed and is being discussed in Germany¹¹. Similar concerns were raised in Italy by advocates of the neutrality of the network at only few days of distance. The first case involved three Google Video executives that were found guilty of infringement of the Italian privacy law for not blocking the publication of a video portraying a disabled being harassed by school mates¹². The reaction of the company was obviously very vehement and underlined the burden that such a ruling would impose on Internet platforms in providing content online. A government bill was also at the centre of intense debate as it proposed to apply the same rules of

¹¹ http://www.spiegel.de/international/europe/0,1518,678508,00.html.
traditional television to online video providers\textsuperscript{13}. The substantially unclear text of the proposed bill did not allow understanding how it would affect the business of professional video content providers.

3. Main Economic Issues behind the NN Debate

The internet sector is effectively modeled as a two sided market. As the broadband infrastructure is becoming the standard in the industry, telecommunication companies are more and more identified with network owners: they own the infrastructure over which the information flows and these allow the two sides of the market to communicate and trade. On the one hand, final users want to access the internet for a number of reasons: to exchange files with other users, to access online entertainment, to gather important information and to use a number of services provided over the net just to number a few. On the other hand, content providers want to upload their material online to be accessed from users. These are private companies, no-profit organizations, governmental bodies, institutions or private citizens owning a website. Their presence on the internet has many different goals. Heterogeneity is also important so that their content is accessed rapidly and efficiently. Figure 1 below illustrates the broadband market structure and highlights the fact that network owners charge both sides to access the internet ($a$ and $p$ represents the access fees in Figure 1).

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{internet_structure.png}
\caption{A stylized representation of the Internet structure.}
\end{figure}

\textsuperscript{13}http://www.repubblica.it/tecnologia/2010/03/01/news/via_libera_al_decreto_romani_ma_nessun_obbligo_per_i_blog-2469666/index.html?ref=search.
Modeling the internet as a two-sided market is the only way of correctly identifying the effects of the policy instruments evaluated and that may be adopted by the relevant authorities in the near future. Using this perspective, the discussion in the next paragraphs tries to disentangle the effects of pricing and other decisions by platforms on all the agents in the market.

Reality is, of course, more complicated than our extreme simplification. A more detailed schematization of the internet structure is provided by Yoo (2004). According to Figure 2, ISPs do not provide direct communication between content providers and final users, but “backbones” act as further intermediaries. Although I address issues that relate to the supply chain in the broadband internet sector, I will largely overlook issues related to the economics of the backbone. 14 Another feature of Yoo (2004) characterization is the presence of two technologies to provide the internet broadband service: the cable modem system and the DSL system. In what follows, however, I shall assume that providing access costs exactly the same to network owners, no matter with the technology adopted.

Figure 2: The basic structure of broadband internet, Yoo (2004).

Further, this review focuses on the neutrality of the fixed broadband internet, as opposed to the wireless technology. The latter is gaining more

14 A detailed treatment of the economics of backbone providers can be found in Economides (2008) and Economides (2006).
and more relevance with the diffusion of smart phones; consequently, its regulatory treatment is creating controversy. The platform, however, is characterized by different standards for the provision of content which would have an important impact on the analysis and, as such, are not addressed here. Finally, DSL systems are coupled with telephone voice network devices so that internet broadband is often bundled with telephony services (or, mainly in the US, with cable television). These important issues are also unfortunately not directly addressed in my review of the theory.

Given these due preliminary clarifications on the approach, I can now introduce a theoretical framework, particularly suitable to address the relevant economic issues in discussing the broadband sector and the proposals for its regulation\(^\text{15}\).

### 3.1 A Theoretical Framework

Economides and Tag (2009) set a simple two-sided framework to analyse the effects of NN regulation. As in Figure 2 platforms or network owners are intermediaries between content providers and final users: final users choose one platform while content providers multi-home (i.e. sign up on both platforms) in order to diffuse their applications, products and services as much as they can.

Suppose platforms \(k=1,2\) are located at the extremes of a Hotelling linear market: final users then choose to pay the access fee to the platform \(a_k\) that provides the highest net utility. The indifferent final user is then identified by the consumer located in \(x\) such that:

\[
v + \alpha n_{vp1} - t x - a_1 = v + \alpha n_{vp2} - t (1-x) - a_2
\]

in which \(v\) is the willingness to pay for access, \(\alpha\) represents the effects of the network externalities, \(t\) is a measure of market power and \(n_{vpk}\) are the expected content providers on each platform. From the previous, the demand functions can be defined:

\(^{15}\) The issues identified and discussed below are mainly pertaining to what Brennan (2010) defines the “market power justifications” of NN.
Content providers instead are multi-homing and they decide to participate in the market whenever the fee established by platform $k$ allows them to at least break-even:

$$\pi_k = An^e_k - p_k - fy \geq 0$$

In which $An^e_k$ represents the advertisement revenue obtained by content providers reaching a given number of final users, $p_k$ is the access fee established by platform $k$, $f$ is the fixed cost of entering the market and $y$ is heterogeneous and it is uniformly distributed between content providers. The demand faced by each platform $k$ from content providers is then:

$$n_{vyk} = \frac{An^e_k - p_k}{f}$$

Economides and Tag (2009) use this model to evaluate two polar situations. The first is the unrestricted duopoly benchmark in which firms compete freely and no regulation is imposed\(^\text{16}\). The second is the situation of NN regulation. According to the authors, this is the case when platforms are forced by regulation to choose a zero access fee to content providers.

In terms of the model, this corresponds to $p_k = 0$. This may look like a rather extreme simplification at first; the assumption, however, captures the sense of what according to Lee and Wu (2009) is the crucial issue of the NN debate: should network owners be prohibited from charging a “termination fee” to content providers that benefit of their final users’ base? In other words, in the mobile phone industry providers pay each other termination fees in order to connect two users that belong to different networks: should ISPs be allowed to do the same or, as many NN proponents suggest, the practice should be prohibited?

Although criticized for being too stylized, this model is often regarded as the benchmark framework for the policy analysis of the broadband industry. One of the shortcomings is the unrealistic restrictions that are

\(^{16}\) Economides and Tag (2009) also study the case of monopoly. Duopoly, however, seems to better suit the analysis of the European broadband market in which LLU should guarantee at least potential entry of more than one provider.
implied on the relative profitability of content providers and network owners (Caves, 2010; Schuett, 2010) \(^{17}\). For my goals, however, it has advantages: it allows an evaluation of the welfare of users, content providers, platforms and society as a whole and how these change in presence of a proposed regulation. Its simplicity makes it suitable for the evaluation of other theoretical approaches proposed in the literature and flexible to allow a stylized assessment of several regulatory scenarios.

### 3.2 Investment and Innovation

One of the major concerns in most network industries is the incentive of the incumbent firm (or firms) to invest in maintenance and development of the infrastructure. The internet sector is not an exception: investment in infrastructure is crucial given the fast rate of technological change and economic expansion of the network. As we shall see, congestion may pose a number of concerns in the years to come as applications developed by content providers and final users demand require more and more bandwidth day after day. On the other hand, innovation from content providers is according to many the most important ingredient of the current success of the internet. The number and versatility of applications and contents that are developed on and for the internet are impressive and probably extremely difficult to quantify. “Deregulationists”, as Wu (2004) defines the group opposing NN regulation, discourage any intervention as the internet provided incentives for innovation to content providers until now, it will keep doing so in the future; for “openists”, however, regulation is needed to preserve in the “broadband era” the early incentives content providers had in the past. The question is then what policy better suits the incentives to investment and innovation of both parties: also, how it is possible to guarantee that the interests of one party do not squeeze the other? The problem is obviously a complex one but I can try to provide a first answer looking at my reference framework and to other contributions in the literature.

\(^{17}\)Valletti (2010) identifies further theoretical shortcomings of the Economides and Tag (2009) model.
In the static model described above, Economides and Tag (2009) find that the equilibrium profits of network owners in presence of unrestricted duopoly competition are lower than in case network neutrality regulation is imposed, i.e. as network owners need to stick to $p_k = 0$.

In other words, in a duopoly situation, a regulation restricting pricing freedom of platforms to content providers reduces competition between the duopolists and leads to a situation of higher profits for platforms, higher welfare for content providers, due to a lower price of access to the internet. Final users, however, are damaged as they face now a higher price of access to the internet. Assuming that investment is proportional to profits, the results of Economides and Tag (2009) seem to suggest that the interests of content providers and network owners are aligned: forbidding “termination charges” on the internet would increase the incentives to improve the network by platforms and at the same time allow content providers to profit from developing new and innovative contents and applications. Cañon (2009) considers a richer framework in which platforms face asymmetric information, non-linear pricing can be adopted and content providers trade with final users. The paper considers both investment and market coverage decisions of a monopolist platform at the same time; the results seems to confirm and sustain the case of the Economides-Tag (2009) approach: restricting platform’s pricing to content providers has a positive impact on investment decisions and induces larger participation from content providers. Musacchio, Schwartz and Warland (2009) adopt a different approach to the question by measuring usage via a click metric, assuming that investment and pricing are not simultaneous but sequential and allowing for a generic number of firms. The results depend on the intensity of the price sensitivity of advertisement revenue compared to the sensitivity of end-users to prices. When these do not differ sensibly, the results of Economides and Tag (2009) and Canon (2009) are confirmed: investment of platforms and incentives to innovate of content providers are enhanced. The same is not true when the two parameters characterizing the two sides of the market are substantially heterogeneous: in that case, price freedom on the two sides is increasing overall welfare.
Competition affects this result: under pricing freedom, competition is fierce and platforms tend to increase the prices they charge to content providers. This acts to reduce the region of parameters for which pricing freedom is welfare beneficial. Choi and Kim (2010) consider innovation incentives of network owners in a both static and dynamic perspective. They provide a further argument in favour of NN, linked to the possibility of congestion on the network\textsuperscript{18}. A platform that invests in extending capacity decreases her ability to discriminate by using prioritized delivery. A regulation prohibiting such discrimination would increase investment incentives; moreover, NN drives platforms to focus on extracting surplus from final users: this is likely to provide better incentives for innovation also to content providers. Krämer and Wiewiorra (2010) also focus on congestion as the force leading to discrimination but explicitly consider entry as a proxy of innovation of heterogeneous content providers. Their findings suggest that discrimination is beneficial in the short-run while long run investment incentives may benefit from NN regulation under certain conditions: in particular, NN is the more efficient regime if the advertisement revenues $A$ of content providers are particularly sensitive to competition.

Caveat 1 summarizes the previous discussion.

\textbf{Caveat 1} On investment and innovation incentives the literature proposes mixed and not conclusive results. However, cases exist for which the interests of content providers and network owners are aligned. Forbidding “termination charges” or not allowing priority discrimination, i.e. imposing NN regulation, may increase the incentives to improve the network and allow content providers to profit by developing new and innovative applications.

\section*{3.3 Discrimination}

The considerations just proposed seem to suggest that NN regulation may have desirable effects, especially for network owners and content providers. The analysis proposed, however, has focused on access to the network and its congestion, while it largely overlooked issues related to the

\textsuperscript{18} Further details on the modelling of congestion are given in section 3.5.
quality of the service received by content providers and final users when accessing the internet. The quality of access, especially the speed and reliability of transmission of the data, is a key feature of the industry: the fast pace of development of the technology stands to witness this.

Maiorano and Reggiani (2009) tackle the issue of quality supply and the possibility that content providers can be discriminated according to their willingness to pay for preferential quality of access. Network owners through the broadband technology features have the possibility to discriminate at a much reduced cost, so it is assumed they offer two different level of quality of access to heterogeneous content providers. The net utility of content providers demanding quality $q_k$ is:

$$u_{cp}(q_k) = q_kA + \alpha_{cp}n_{fu}^c - p_k \quad k = L, H$$

in which $A$ is the heterogeneous evaluation of access and $\alpha_{cp}$ is the sensitivity of content providers to the network externality of final users. As opposed to Economides-Tag (2009), it is assumed that content providers are not necessarily profit maximizers: although this has no implications for the model, it aims to reflect the fact that content providers are very heterogeneous and include both companies and individuals but also organizations and a number of other no-profit entities. Final users, on the other hand, are not only affected by cross-network externalities (i.e. the availability of content) but also by direct externalities; they also don’t have a perfect perception of quality when they access the content of high type providers. The net utility they get from accessing the internet is:

$$u_{fu} = v + \alpha_{fu}^1n_{cp}^c + \alpha_{fu}^2n_{fu}^c + \beta Q(h) - a$$

in which $v$ is the heterogeneous evaluation of access, $\alpha_{fu}^1$ is the sensitivity of final users to the network externality of content providers, $\alpha_{fu}^2$ is the sensitivity of final users on the externality they impose on each other, while $Q(h)$ is an index of the quality of the access as perceived by final users that may not perceive high quality as good as it is, $q_{fu} > h$. NN in this setting is interpreted as a ban on the possibility of quality discrimination: this leads network owners to supply a unique quality to content providers.

The richer framework allows performing a number of comparisons between
the NN case and the quality discrimination one. Results seem to suggest that in presence of quality discrimination both network owners and content providers are better off. Final users are the only group to benefit from NN regulation: although banning discrimination reduces participation, reduced prices more than compensate the first effect. All the recalled results depend crucially on the values of the parameters: the negative effect of NN for content providers, network owners and overall welfare is reduced, for example, in presence of congestion (i.e. a negative externality of final users on content providers). On the other end, a particularly positive externality of content providers on final users also implies that final users do not benefit from NN, as the latter implies a reduced number of content providers participating to the internet. Finally, imperfect quality perception makes NN more desirable for final users. The conclusion that non-quality discrimination is not a good argument in favour of NN regulation is also reached by Hermalin-Katz (2007). Their model is more general as platforms can supply a range of qualities, although the description of the market is more stylized. The conclusions are that the range supplied under no regulation is not socially optimal; it is, however, larger under discrimination than under NN. Furthermore, a regulation that compels network owners to supply a unique specific low quality in the range, damages final users as opposed to a restriction to a unique but freely set quality: in this case, the gain in participation does not compensate for the lower quality received by final users. Another interesting result is that a regulation that forbids to charge content providers, comparable to the one suggested by Economides-Tag (2009), would induce network owners to supply a reduced level of quality with detrimental effects for overall welfare.

The findings can be summarized as follows:

Caveat 2 In presence of quality discrimination both network owners and content providers are better off. Final users are the only group to benefit from net neutrality regulation: although banning discrimination reduces participation, reduced prices more than compensate the first effect.
3.4 Integration and Foreclosure

A relevant issue in markets characterized by competitive bottlenecks, as the internet broadband sector, is whether platforms have incentives to foreclose competitors and monopolize the market. The economic analysis of the internet as a two-sided market just proposed, however, seems to dismiss the possibility of undercutting one side as an instrument to foreclose access of other providers to the internet. The logic is the following. Suppose a platform wants to foreclose the rival by attracting all content providers. The only feasible way would be to undercut rivals in setting the access fee for content providers; this strategy, however, would imply increasing charges to final users. A platform that attracts less final users is then unlikely to avoid multi-homing and foreclose the other platform as content providers would still like to access as many final users as possible. Armstrong-Wright (2007) suggests that a platform then, instead, could offer to content providers an exclusive contract. As in the Economides-Tag (2009) model, multi-homing content providers have their surplus totally extracted: the ISP offering a small discount leads them to accept an exclusive contract. The result is foreclosure on the content providers’ side. Foreclosure, however, is only partial as not all final users subscribe to the platform that supplies all the content: some may either choose the no content platform or just opt out of the market.

**Caveat 3** Partial foreclosure is possible on the internet by offering exclusive contracts to content providers.

The adoption of exclusive contracts between platforms and content providers naturally leads to the issue of integration along the production chain. The latter is a very common feature of the internet market: many ISPs also provide a number of content and services that are not linked to access to the internet. This feature has triggered a number of concerns regarding competition on the internet and the reduced cost discrimination allowed by the broadband technology has strengthened the case for rules that protect the openness and accessibility of the internet to everyone.
Rubinfeld and Singer (2001) and Högendorn (2005) raise concerns about the anti-competitive potential of integration between content providers and platforms. The former, while not specifically focusing on NN, suggests that an integrated platform has incentives to discriminate access of final users to other contents and applications. The reasoning of the authors applies to the AOL-Time Warner case: the very American nature of the case may imply that similar considerations do not apply to content providers and ISPs with a more transnational reach (Singer, 2007). The latter proposes a more subtle argument: one effect of an open access regulation is to harm the integration of some web services; this, in turn, does not favour supply of content variety on the platform but actually deters it, as integration and content supply are likely to be complementary. The considerations they provide, however, seem to apply in a market where competition focalizes on applications rather than on the speed of connection. In recent years, especially in Europe, the strategic variable is instead the speed of connection. To summarize:

**Caveat 4** Integration may be beneficial if competition focuses on applications supply as it leads to more variety; it provides incentives for discrimination if competition focuses on the speed of connection.

### 3.5 Congestion Concerns

The internet expansion in the last decades and the extension of bandwidth intense applications available these days have raised concerns about the adequateness of the current infrastructure to deal with the ever expanding demand for services or, in technical terms, with the congestion of the network. Maiorano and Reggiani (2009) suggest how the impact of a NN policy that bans quality discrimination may be socially desirable in presence of concerns of congestion: the intuition is that no regulation increases participation of content providers and, as a result, of final users, leading to increased traffic on the network. Cheng, Bandyopadhyay and Guo (2011) directly assume that the internet is characterized by
congestion. In their setting, quality discrimination corresponds to prioritizing packages from content providers that pay for preferential delivery. A modeling approach à la Hotelling is adopted for the net utility of final users:

\[ u_{fu} = v(\lambda) - tx - \frac{d}{\mu - \lambda} - a \]

in which the evaluation of network access \( v(\lambda) \) depends on the arrival rate \( \lambda \), \( tx \) represents the distance of the user from the favourite content and \( \frac{d}{\mu - \lambda} \) is the cost of delay for final users, depending on their unit cost of delay \( d \) compound by the expected waiting time \( \frac{1}{\mu - \lambda} \) in a queuing system of capacity \( \mu \). In a prioritized system, where users \( x<1 \) access content from the preferred content provider, the waiting time is reduced to \( \frac{1}{\mu - x\lambda} \).

This way of modelling congestion and prioritization follows the theory of \( M/M/1 \) queuing systems which, according to Mc Dysan (1999), is a good description of internet traffic.

Regulation banning prioritization implies a shift of surplus from platforms to content providers; final users and total welfare are mostly unaffected unless platforms are very heterogeneous in their characteristics. The previously discussed papers of Choi and Kim (2010) and Krämer and Wiewiorra (2010) adopt a similar \( M/M/1 \) traffic modelling approach; however, slight changes in the assumptions lead to different results on the desirability of prioritization as compared to a regulation banning it and, as such, the policy implications. For this reason, similar conclusion as in Caveat 1 also apply to congestion and its effects for NN.

4. Market conditions in the EU

In Europe, there is little presence of cable television across Europe as a whole, although DSL appears to be gradually losing its status as the preferred broadband access platform for new customers, as highlighted by Table 1 below. Moreover, in the period January 2008 – January 2009,
72.7% of the new broadband lines were by means of DSL technologies, while 27.3% of connections used other type of technologies, which is a decrease for DSL of 5.7 percentage points compared to a year ago, mainly to the benefit of high-capacity fibre and wireless offers. Alternative operators attracted more new subscribers than did the incumbents (the incumbents’ DSL lines increased by 13.2% in the last twelve months, while the competitors’ DSL connections rose by 15.1%). At EU level, the incumbent’s broadband market share (excluding resale) continues to decline, and in January 2009 stood at 45.6% compared to 46% in January 2008 and 46.8% in January 2007, as illustrated in Figure 3.\textsuperscript{19}

<table>
<thead>
<tr>
<th>Broadband technologies share</th>
<th>DSL</th>
<th>Cable</th>
<th>Fibre</th>
<th>WLL</th>
<th>Satellite</th>
<th>Leased lines</th>
<th>PLC</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009 January</td>
<td>79.4%</td>
<td>15.3%</td>
<td>1.4%</td>
<td>1.1%</td>
<td>0.1%</td>
<td>0.2%</td>
<td>0.0%</td>
<td>2.5%</td>
</tr>
<tr>
<td>2008 January</td>
<td>79.9%</td>
<td>15.3%</td>
<td>1.3%</td>
<td>1.1%</td>
<td>0.1%</td>
<td>0.1%</td>
<td>0.0%</td>
<td>2.2%</td>
</tr>
<tr>
<td>2007 January</td>
<td>80.8%</td>
<td>15.5%</td>
<td>1.1%</td>
<td>0.8%</td>
<td>0.2%</td>
<td>0.2%</td>
<td>0.0%</td>
<td>1.3%</td>
</tr>
<tr>
<td>2006 January</td>
<td>81.3%</td>
<td>16.0%</td>
<td>1.0%</td>
<td>0.6%</td>
<td>0.3%</td>
<td>0.3%</td>
<td>0.0%</td>
<td>0.5%</td>
</tr>
</tbody>
</table>

Source: European Commission, 14\textsuperscript{th} Report on the Implementation of the Telecommunications Regulatory Package - 2008

Table 1: Broadband Technologies in the EU.

In the EU, the prospects for infrastructure competition are dimmer, since only a few areas (Benelux, parts of France, Germany, and the UK) are now served by competing broadband infrastructures (Cable and ADSL). In most of the EU, it is thought that the rollout of competing broadband networks – effectively from scratch – cannot be achieved without some form of access to incumbent networks, at least in a starting phase. This means the ISP landscape in Europe is likely to remain so in the foreseeable future: fewer competing infrastructures, but more market players, many of which rely on access to the incumbent’s network. In terms of NN, competitive broadband based on wholesale alternatives (bitstream access, shared access or LLU) represent meaningful competition as long as the incumbent is prevented (by technical, regulatory or contractual means) from adversely impacting the quality of the service that the competitor offers to its own end-users. As a practical matter, this means that most Europeans may have more than two viable alternative providers of broadband Internet access. How this potential competition will translate into actual competition is at the moment


Figure 3 Incumbents’ vs. New Entrants’ Retail Market Share by Technology, Jan. 2009
much less clear. Providing actual alternatives to the highest number of EU households should be one of the policy objectives of the relevant authorities.

5. Policy Implications and Discussions

5.1 Regulatory framework in the EU

The Europe has accepted a key regulatory philosophy that is to regulate only where necessary to address market power. In the EU, there is an institutional separation of power between the EC and the Member State NRAs. The Commission seeks to harmonise the whole process across the Member States and has specific powers of veto over certain decisions, while NRAs implement the measures in their own countries. European regulators have the ability to impose non-discrimination obligations on network operators that have market power. They have authority to impose interconnection obligations, and if necessary could do so even on operators who do not possess SMP\(^{20}\). They also have substantial ability to protect the consumers’ rights, for example by requiring network operators to disclose deviations from NN either online or in their contracts with end-users.\(^{21}\) These powers to protect consumer are particularly important, in that they potentially enable NRAs to ensure informed consumer choice (Scott Marcus, 2008).

In the EU, the current regulation of ECS came into force in 2003 and is already subject to a debate over how it should be reformed in 2010. In addition, competition law is viewed as an ex post complement to the application of ex ante application of the ECS. To the extent that competition law addresses market failures such as tying, it provides a sophisticated alternative to regulation. Under the Directives, the Commission first establishes a list of markets where ex ante regulation is to be considered, the markets being defined according to normal


competition law principles. These markets are then adapted and analysed by NRAs with the aim of identifying SMP (on a forward-looking basis). Pursuant to Article 16 of the Framework Directive, the regulatory framework only permits the imposition of ex ante regulation where one or more undertakings are found to have SMP (Cave and Crocioni, 2007).

5.2 Regulatory concerns for the EU

The economics analysis and the overview of the internet markets provided in the previous sections seem to suggest that several regulatory concerns arise and are likely to become even more relevant as the sector will keep expanding in the near future.

The European internet sector is relatively competitive when it comes to access to final users: this is in principle guaranteed by the local loop unbundling (LLU) regulation mandated by the European Commission. In terms of the economic framework outlined in Section 4, it can be assumed that the final users’ segment is imperfectly competitive (or, at least, potentially competitive). According to the theory, however, platforms would also be able to extract from content providers a good amount of their surplus, as the latter are interested to reach as many final users as possible. This observation triggers a first concern: is the current institutional setting sufficient to guarantee enough access on the content providers’ side?

There are, however, two points to notice. First, as previously underlined, content providers are a rather heterogeneous bunch of agents and not all of them may be interested or willing to pay to multi-home. A better description of reality is that some of them actually pay other providers to use their content on websites: search engines on non-search websites are an obvious example. Moreover, in many cases ISPs have their own web

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22 The first Recommendation on relevant market (EC 2003) identified those markets which, in the Commission’s view, may warrant ex ante regulation. The first Recommendation identified 18 markets. The draft second version published in 2006 reduces it by a third, notably eliminating most retail markets. Unlike the previous regime, markets must be defined in accordance with the principles of competition law. NRAs may vary the markets subject to objection by the Commission. Member States can also add markets, using specified (and quite exacting) procedures.
portal that features content from other providers. The distinction between content providers and ISPs/platforms is more difficult to trace in reality than in theory and the relationship between these more nuanced. This is also reflected in the charges for access from ISPs to content providers, which are unlikely to even approximate the full extraction of content providers’ rent predicted by theory.

Following the same lines of reasoning, it looks difficult to figure out an evolution of the internet in which peer to peer agreements and the end to end principle are substituted by a preferential system based on differentiated access charges between ISPs. Even in case these scenarios materialize, the concerns may not be well grounded. Business practices aimed at screening providers’ willingness to pay for a higher quality service, in fact, are likely to have a positive effect for most of the players involved: my review in Section 3 highlighted how discriminatory access charges may lead to enhanced quality supply and not necessarily to a lower investment on the network or a lower participation of content providers. The effect on web’s users is, however, less clear cut and it may raise concerns that deserve some attention from the policy maker. As discussed in some detail below, however, this type of concerns may be often more effectively addressed by competition policy rather than “ex-ante” regulation.

As the expansionary trend of the internet industry does not seem to slow down, the increase in participation on both sides of the market raises the question of whether the current infrastructure allows efficient traffic management. Quality discrimination would make this effect more pronounced, as it encourages higher participation of both content providers and final users. Increased incentives to innovate of content providers may also magnify problems of congestion. In presence of major traffic disruptions and congestion two scenarios look possible, one more likely in the long run and the other one in the short run. The increased profits encourage telecom companies to invest and extend their infrastructure. This would reduce the likelihood and the incidence of congestion on the network. Investment, however, does not take place instantly: between investment decisions and their materialization, there is always a
physiological lag. In the meanwhile, the immediate response from ISPs could be to prioritize traffic according to queuing rules. The transparency of those rules may not be crystalline: the danger is that claims of congestion may hide unfairly competitive practices. The issue surely deserves a careful analysis and, perhaps, a regulatory response.

### 5.3 Ex ante vs. ex post regulation

Generally speaking, ex ante economic regulation only makes sense in those markets where structural competition problems persist. In the markets opened to competition, ex ante regulation is too blunt an instrument to distinguish between vigorous competition and anticompetitive acts. At present, it is generally accepted that regulatory intervention should remain minimal and limited to ex post intervention in case of anticompetitive practices, as ex ante regulation, particularly in markets opened to competition, necessarily imposes costs on society.

The NN debate is something about pros and cons of ex ante and ex post regulation. Some advocate ex ante regulatory authority to promote NN, as this is the only way to guarantee openness to Internet. In addition, antitrust enforcement is burdensome and slow, making it difficult to apply to a fast-changing technological world. In contrast to this view, opponents argue any ex ante regulation in the sense of net neutrality will cause huge cost and harm economic and social benefits. Many economists regard access tiering as a potentially harmful practice that may require regulation in the future. However, until economic harm has been demonstrated, they believe that proscriptive ex ante regulation is not warranted. Therefore, there is no need for NN regulation at all but rather an effective competition policy that guarantees a sufficient level of competition.

The EC has relied on a combination of ex ante and ex post remedies to control market power in the telecommunications, i.e. sector-specific regulators usually intervene ex ante, while competition authorities act ex post. Witnessing the increasingly effective competition in the telecoms markets, the EC has showed their favour of abandoning sector-specific
regulation. They aim to concentrate regulation on the markets with growing competition problems, such as access to high speed broadband services. By creating sector-specific rules designed to stimulate competition, market power can be constrained. The idea of the EC is that competition will suffice to punish anticompetitive deviations from NN.

5.4 Policy analysis

My previous analysis reviewed the basics of the EU regulatory setting and the concerns posed by the current structure of the internet sector. In the light of these and the policy instruments available, I now give an overview of the policy scenarios that the regulator may face in the near future. Kocsis and de Bijl (2007) outline three possible alternative regulatory scenarios as the outcome of the NN debate. On one extreme, if the hands-off party prevails, the market is left free to adjust, reducing the regulatory interference to the minimum. Several sources of welfare losses may arise in such a situation: I stressed issues related to investment incentives, in presence or not of congestion, uncompetitive discrimination and access blocking. At the other extreme stands an extensive NN regulation of the sector which would ban access-tiering or, even more strongly, any type of termination charge and similar arrangements. Given the state of research on NN, characterized by non-conclusive theoretical results and rather limited empirical evidence, the risk of a regulatory failure seems concrete. That would possibly impose more important social costs than no regulation at all. An intermediary type of solution may be relying on interoperability requirements that impose rather limited obligations on ISP operators. Interoperability requirements on ISPs postulated by ex-ante regulation have two major advantages. The first is to directly tackle what seems to be the major problem of the future internet: the possibility of unfair and anti-competitive discrimination of content providers by ISPs. The second advantage is that the burden of proof would be transferred from the

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23 The Commission has revised its recommendation on the relevant markets. Eleven of the former eighteen regulated markets (Recommendation of 2003) will no longer be subject to ex ante regulation and will be made subject to ex post regulation. In practice, this means that general competition law will apply to those markets.
content provider (or the damaged final users) to the ISP. This seems efficient on the grounds that the data on traffic may be private information of ISPs and unlikely to be available or disclosed to second parties, especially to commercial rivals\(^{24}\). In conclusion, I share with Kocsis and de Bijl (2007) favour for a third way to regulate the internet in Europe; unlike them, I believe that only interoperability should be the principle to be mandated. A second solution, a minimum quality standard, also advocated by Brennan (2010), may not be appropriate in the EU. First, despite the EU market being rather competitive, it is far away from the ideal textbook case of perfect competition. In that case minimum quality standards are unlikely to improve welfare and Krämer and Wiewiorra (2010), although in a different context, show it. Second, the interoperability prescription should be sufficient to guarantee a full exploitation of the positive externality present on the internet and at the same time guarantee adequate quality over the internet.

As suggested by my analysis, the type of discrimination the regulator should be the most concerned with is particularly likely to happen in presence of congestion. Congestion has not been up to now a major problem on the internet, although a number of episodes have been registered and the undesirable consequences are at times experienced by users; however, congestion may become the number one concern in presence of both an increased number of internet users and content providers and the diffusion of bandwidth intensive applications and flat rate pricing from ISPs. Yoo (2006) underlines the features of the internet that make of it a “club good”: once an individual gets access, his cost of usage does not fully reflect the cost imposed to other users, inviting overconsumption. Transaction costs, however, make it difficult for ISP to charge users and providers according to their consumption of bandwidth. The widespread diffusion of flat contracts also makes it difficult to move back to metered pricing, as that would inflict a further psychological cost on users. The adoption of regulatory restrictions may then have to be

\(^{24}\) In a recent report [http://www.economist.com/node/16941635] “The Economist” seems to identify interoperability as the most endangered feature of the internet at the moment. The report suggests that the recent trend may lead to the emergence of internet as a structure of rather isolated sub-networks only partially interconnected between each other.
considered in presence of risks of congestion. One possible solution to the problem is to allow discrimination on the end-users side rather than on the content providers’ side. While the latter would increase entry on the internet, the former could be designed by a last mile provider in a way that even a flat rate contract imposes end-users an economically efficient bandwidth use. The flat rate access fee can, in fact, be set equal to the average congestion cost inflicted to the system by the average user. This solution, however, may not be as effective in the EU. The LLU provision of the EC imposes to ISPs to resell bandwidth and allow entry of other ISPs. As this is equivalent to increasing competition, competitive forces may target prices and access charges so that the efficient anti-congestion access fee may not be a sustainable equilibrium. The market may not, then, deliver the desired outcome and a regulatory intervention is needed to tackle congestion. One option is to target all the bandwidth intensive practices. Home networking or, in other words, the number of computers that can access the internet through the same connection will have to be capped. Notice that the cap solution has a further advantage: a monopolist last mile provider would tackle home networking via a raised access fee on end users: this would penalize low volume users that are either excluded of the internet or pay an access fee that cross-subsidizes multiple users. Regulatory restrictions in presence of congestion do not need to materialize in bans, which are usually not well accepted by users. An alternative option is to let the last mile ISP price discriminate end-users desiring to home network, which can adopt a price premium on networking connections. Bandwidth can be used indiscriminately for other purposes that may cause congestion. These are the use of devices such as internet phones, gaming consoles and Wi-Fi rooters. The ability to act as a file server (as, for example, in peer-to-peer file sharing) and the use of the internet for commercial uses are also bandwidth intensive activities. Increased price discrimination can prove an efficient management tool also in these cases. The effectiveness of ISPs price discrimination, as underlined, may be jeopardized in presence of harsh price competition: actual or potential entrants may reduce the charges that ISPs can impose at the last mile, not
allowing a privately effective response to congestion concerns and implying the regulator needs to act directly, using instruments as price premia.

The policies just discussed have at least two limitations. First, in presence of congestion ISPs may be tempted to mask undesirable anti-competitive discrimination behind the need of prioritizing traffic. As pointed out by Valletti (2010), regulation may increase rather than decrease the likelihood of “sabotage”. However, the regulator should monitor this type of practice and, possibly, intervene in case it becomes prevalent. Second, focusing on reducing the traffic may lead to undesirable long run incentives. This can act as a substitute to the achievement of more desirable long run goals, as the improvement and extension of the infrastructure or the compression of the data generated on the web: traffic reduction may actually deter the investment required.

These are sound concerns and they lead us to the following conclusion. The policies discussed may be effective and should be adopted only under three important qualifications: the first is that congestion of the last mile constitutes a primary problem of network management; the second is that the restrictions imposed are contingent and temporary; the third is the presence of an active competition authority which invigilates and can guarantee the rights of content providers and final users in presence of unfair discrimination.

6. Conclusions

The Internet became a key industry in just two decades. In this context, the broadband technology, with faster speed of delivery of data packets and being provided mostly bundled with other services (i.e. telephone or cable TV), allows network owners to potentially discriminate between content providers at a much reduced cost. These features have evoked a heated debate over whether the network owners should be allowed to apply different treatment to data packets associated with different services,

25 Krämer-Wiewiorra (2010) also support an intervention of the regulator in presence of strategic quality degradation.
applications, destinations or devices. Concerns of anticompetitive
behaviour from Internet service providers (ISPs) call for the so called NN
regulation. NN has been a contentious topic since its appearance in the
policy debate. On the one hand, opponents of NN, such as most ISPs
argue that they should be able to profit from their investments and platform
discrimination is necessary for future innovation on the Internet. On the
other hand, proponents of NN, such as consumer groups and content
providers like Google, Yahoo!, eBay, Amazon, believe that platform
discrimination will block competition and distort content providers’
innovation incentives.

In Europe, despite the little presence of cable television across Europe as
a whole, the ISPs market seems effectively competitive and most
Europeans have more than two viable alternative providers of broadband
Internet access. More importantly, existing policy tools, as an active
competition law, appear sufficiently effective to complement any level of
regulation. Given the institutional and market setting of the EU, I have
identified and analysed the main economic issues behind the NN debate,
focusing on the policy implications of the existing theoretical analyses. The
final goal was to discuss and evaluate, in the light of the economic
principles, some possible concrete regulation proposals. The main
conclusion is that a European policy-maker should be mainly concerned
about: 1) unfair and anti-competitive discrimination; 2) the possibility of
congestion. Both of the previous may lead to an undesirable fragmentation
of the internet. To make things worse, in presence of 2), the undesirable
practices like 1) may find sound justification from offending ISPs. For
example, discrimination that harms access to the content of a rival
business or slows down in the internet traffic may be justified on grounds
of traffic prioritization to avoid congestion. “Ex-ante” regulation can
constitute an effective solution under certain circumstances. These are: a)
a limited in scope and extent and b) being contingent to the challenges
proposed by network management. In this light, regulation should mandate
ISPs to guarantee interoperability and a smooth flow of the traffic over the
internet. At this stage more stringent NN regulation should be avoided as
the risk of regulatory failure would be quite high.
Further intervention is needed in presence of congestion. Competition at the last mile, as protected by the EC rules, may not help manage congestion effectively as two or more ISPs share the same infrastructure. Other type of restrictions or price premia may then have to be adopted; for example, limitations on attaching bandwidth intensive devices, on home networking and on the ability to operate file servers. These limitations would affect the end-users who are high volume users of the internet. As long as the limitations are not selectively imposed to harm a specific content provider they can be an efficient network management tool of congestion.

The final message is that ex-ante regulation should be completed as much as possible by an effective ex-post regulation in the internet sector: Europe and its member countries, given their institutional setting, are in the best conditions to achieve this goal. In that case, a NN regulation could be limited to very few relevant provisions so that an increase in the efficiency of the system could be matched by a lower risk of regulatory failure.
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