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Market Definition, Market Power and Regulatory Interaction in Electronic Communications Markets

CERRE study

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Executive Summary

The move to packet-switched networks and the increasing role of Over The Top (OTT) players in providing services over these networks require a fresh look at the market forces shaping the industry. It requires a rethinking of market definitions and the assessment of market power, followed by a re-evaluation of the role of regulation in electronic communications markets.

OTTs' apps have become a central element of the value proposition made by telcos to users. While they have made the combination of internet access, communication and media services more valuable, it is unclear to what extent telcos can monetise these developments. Partly, these apps replace formerly vertically integrated services by telcos, raising the possibility that telcos may actually suffer from the increased value stemming from additional OTT apps.

This report makes a number of fundamental points. First, there is a basic property of complementarity between infrastructure products and content services. Internet connections (possibly with certain quality characteristics) are necessary to enjoy the benefit of Internet content, and vice versa. It follows that the societal benefits from OTTs' apps and ISPs' cannot be accounted for separately. To provide incentives for innovation at both layers, OTTs and Internet Service Providers (ISPs) must both benefit from this joint surplus creation. As a corollary, if the benefits exclusively go to OTT providers and consumers, the risk is that necessary and mutually beneficial investments in network infrastructure will be delayed or even not undertaken. A regulatory environment which heavily constrains the pricing and contracting of ISPs tends to lead to such an outcome. In the current regulatory environment ISPs may fear that the benefits from investments will be absorbed by consumers and content providers with little benefits left for the investing party.

Secondly, the business models of OTTs are diverse and evolving. Similarly, ISPs should be allowed to experiment with new business models, as their traditional revenue models have been challenged by the success of several OTT apps for communication and messaging. This includes specifying new types of contracts offered to consumers and OTTs. For instance, a mobile contract may include pre-installing certain apps or may provide bundled discounts for particular services on the basis of contracts signed with the respective content or app provider. While these contracts are subject to scrutiny by competition authorities, *ex ante* interventions that restrict such differentiated offers appear to be misguided, provided of course that the parties involved, particularly consumers, are informed beforehand about the contractual terms in a clear and transparent manner.

Thirdly, the efficiency of pricing solutions should be analysed in light of recent economic theory that suggests that ISPs and OTTs are multi-sided platforms. For instance, ISPs cater to consumers

and content providers and many OTTs cater to consumers and advertisers. General insights from multi-sided platform industries are therefore relevant: neither prices below cost nor very high prices on one side are indications, *prima facie*, of anti-competitive behaviour, rather they are means to internalise externalities among the various sides. Hence, competition authorities and regulators have to take these interactions into account and should not investigate one side of the market in isolation.

The fourth point is that a particularly important application of a multi-sided approach concerns the ongoing debate on the so-called "net neutrality" (involving restrictions on prices charged by ISPs to OTTs, as well as on traffic management techniques). A strict notion of net neutrality leads to an inefficient use of existing network capacity and presumably socially insufficient investment, although the exact implications on investment are complex and require careful consideration. An inefficient use of network capacity also limits the development of those innovative services, which rely on quality of service. If Europe is a laggard in the development of, e.g., e-learning, e-mobility, and e-health services this hampers innovation and the growth potential of the European economy as a whole.

Finally, when defining markets, demand substitutability should be the key criterion for market definition. If multiple technologies can be used for the same purpose, all providers of these different technologies are competing in the same market. This applies also to specific services. For instance, a SSNIP[1] test for mobile voice services must take all relevant substitution possibilities into account. In particular, consumers may switch to OTT services if they experience a price increase for traditional voice services. Also, they may substitute parts of their calls by messages (SMS or substitute services by OTTs such as WhatsApp). Allowing for flexible business models, including two-sided pricing and differential access, implies that an ISP operates as a platform that manages the interaction between content providers and end users. Here, a SSNIP test can still be carried out, but it must include cross-group externalities and associated feedback effects. In particular, an ISP expanding the user base attracts more tailor-made offerings by OTTs. Users consider the level and composition of service offerings as an important determinant for deciding which ISP to join. Ignoring these interactions would lead to too narrow definitions of markets.

More generally, when carrying out market definition, two products should be included in the same market if the demands of the two products are strongly interrelated. In platform markets, it is sufficient that the demands of two firms are strongly interrelated on only one side. Based on substitutability (or complementarity), some OTTs belong to the same market as ISPs. This calls for a wider definition of the relevant market and, if subsequent analysis shows that remedies have to be introduced, equal treatment of the players affected.

[1] Small but Significant and Non-transitory Increase in Price.

However, the legal treatment of OTTs is in general not clear, and it is determined case by case. As market power issues raised by OTT services are not congruent with transmission-related positions of market power, the New Regulatory Framework is unlikely to address the relevant problems comprehensively and adequately. Rather, OTTs require an independent and separate analysis as to when and why an intervention is needed and whether competition law alone can address relevant issues of market power or where regulatory intervention may be justified. There is little economic rationale, however, for treating OTTs offering communication services any different in relation to privacy and data security requirements.

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1. Introduction

Local access networks of telecommunications and cable companies, as well as mobile broadband, have become a key infrastructure of the European and world economy, as they give users access to the Internet. In addition to communication services, content, on-line shopping requests, and advertising are delivered via the Internet to end-users. The Internet also allows users-citizens to communicate and interact in an unprecedented way and to offer user-generated content.

In the Internet value chain, one can distinguish between various actors at different layers. In addition to advertisers and end-users, we can distinguish between content and service providers on the one hand and Internet service providers (ISPs) on the other. Horizontal and vertical integration is very common. In particular, ISPs typically offer additional services and several content and service providers are active in various areas.

Content and service providers transfer their content and service to the end-user via a broadband network. Hence, ISPs should be seen as two-sided platforms as they provide the link between content and service providers on one side of the market, and end-users on the other side. Often, content providers obtain their revenues from advertisers. Therefore, content providers can also be seen as two-sided platforms when they provide the link between third-party content offers and end-users, or between advertisers and end-users. In some cases, there is a chain of more than two, two-sided platforms linking advertisers to end-users. An example of this could be an advertiser posting an ad on an online media, which is accessed via a news aggregator such as Google news, through a mobile device using an ISP, by an end-user. End-users care about the availability of content and services, and content and service providers care about participation and usage by end-users. End-users may also care about the volume and features of advertising. The term 'cross-group external effects' was coined to describe a situation where each side cares about participation and usage decisions on the other side. Thus, the market for connectivity products is characterised by cross-group external effects between two sides of the market.

The Internet is characterised by strong complementarities between connectivity products on the one hand and content and services on the other. We observe varying degrees of competition, both at the connectivity provider layer, and at the content and service provider layer. In the case of the former, competition depends on the physical location (in particular, urban versus rural) and end-user segment (business versus residential). With respect to the latter, it depends on the type of application or market segments (e.g., digital music or travel services). Competition within a particular market segment may be complex and may involve different business models competing with each other. For instance, Google, Ebay, and Amazon directly compete with each other as different retail environments, with the three companies characterised by very different

business models. The degree of competition depends on the specifics of the market, including how costly it is to switch to a competing offer (e.g., because personal data cannot be transferred easily) and how important participation and usage are by other potential participants. Moving to a competing offer can lead to switching costs that can be a source of market power. However, such costs, while sometimes empirically found to be relaxing competition, are in general ambiguous. The importance of participation and usage by other potential participants leads to network effects that are thoroughly analysed in this report.

ISPs are often regulated, partly in an asymmetric way violating technological neutrality. In particular, traditional telcos are subject to wholesale access obligations and have to offer connectivity products to virtual operators and operators that lack part of the network, typically the last mile. In addition, other parts of the value chain may be subject to regulation. This applies to some media. However, the nature of regulation is very different and, in terms of interfering in the pricing decisions, the most intrusive regulation has arguably occurred at the layer of ISPs.

The typical business model of telco and cable companies is to offer contracts with monthly payments ('all-you-can-eat' for some services; usage dependent for other services) or prepaid contracts, which often allow for access to the Internet. As far as revenues are concerned, connectivity providers could, in principle, receive funds both from end users and content and service providers. However, under a particularly strict notion of net neutrality, the latter 'retail' price is regulated and set equal to zero in which case content and service providers cannot directly contribute to revenues for the ISP.

Standard instruments for market definition are not directly applicable to platform markets and require modification. Regulation of communication services typically neglects the effects of regulation on the behaviour of content and service providers. These effects are relevant even if the narrow focus of the regulator is on short-term consumer welfare. Due to possible market power issues at the content and service provider layer, neglecting the effect of regulation of connectivity products on that layer can turn out to be highly problematic. It risks that regulatory intervention is off the mark as the interaction due to complementarities and cross-group external effects is ignored. As is well known to a number of economists, ignoring the two-sided market nature may lead to fallacies in regulation and competition policy.

Beyond short-term price effects, investment issues should be taken into account. It is possible that tension exists between short-term policy goals of low prices and the long-term goal to provide investment incentives in infrastructure and services. To properly evaluate the effect of policy interventions on innovation dynamics, the complementarity and two-sided market nature of the businesses models of many content and service providers, as well as of connectivity providers, must be taken into account.

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This report sets out to present the state of play in European electronic communication markets. A particular emphasis is on the recent development of OTTs. After briefly describing a stylised model of an electronic communications market, the report draws some central lessons from economic theory on the interaction of ISPs and OTTs. This includes insights applicable to the net neutrality debate. The report then continues to elaborate on market definition and market power. Finally, before concluding, the report addresses the questions of whether, and how, OTTs can and should be regulated and whether, and how, regulation of traditional electronic communications providers should be modified.

2. State of play in electronic communications markets

An overview of electronic communications markets (ECMs)

Electronic communications markets are a key sector for the modern economy and society. The Internet, together with local access networks, is a general-purpose technology. This is in contrast to the traditional telecommunication networks that allowed for the delivery of voice calls (and some data via fax) and traditional cable networks for live television and radio programs. On packet-switched networks, very different types of content are transported across the network.

Compared to the 'old' communication networks, the change to packet-switched networks, and a large increase in capacity both of access networks and core networks, have enabled the development of new services and the partial replacement of the traditional distribution of media content. Examples of 'new' offerings are online shopping, online gaming, online banking, social networking, video conferencing, and cloud services. The replacement refers to the delivery of television programming via broadband. Cable networks, by contrast, developed in the opposite direction. They were built to deliver media content and were upgraded to two-way communications, delivering Internet services including communication services. Media content includes offerings by traditional media (newspapers, radio stations, and television channels) as well as new, pure online players. Here, news aggregators have become an important access possibility for consumers. Some aggregators are currently moving into media production themselves (partly through long-term vertical contracting). Examples include Netflix and Amazon. This poses challenges for media regulation. However, this issue is beyond the scope of this report.

Traditionally, fixed line telephony and, in the early days, mobile telephony were dominated by national incumbents. With the early liberalisation process, other firms, some of them operating only in one country, entered mobile telephony. Cable networks have become strong competitors for broadband access in several countries. In recent years, EU-wide players have emerged. In cable, Liberty Global has become the pre-eminent cable operator. It is active in 12 European countries and is the strongest cable operator in many of them. In mobile communications, Vodafone has become an important player in the EU with revenue of 44 billion pounds in 2012/2013 and adjusted operating profits of 14 billion pounds. It derived 18% of its revenues in Germany, 13% in Great Britain, 11% in Italy, and 9% in Spain.[2] A small number of former state-owned telcos have developed a strong presence in various member states (and

[2] See Vodafone Group Factsheet 2013, available at: http://www.vodafone.com/content/dam/vodafone/investors/factsheet/group_factsheet.pdf.

outside the EU). A more recent phenomenon is cross-technology consolidation, as exemplified by the merger of Vodafone (which was active via unbundling in the fixed network) and Kabel Deutschland. This merger leaves Vodafone as a major player in cable in Germany.

Consumers can use different access networks as substitutes for one another, or as a mix. These include consumption 'on the go', consumption at hubs, and consumption at home. Depending on the location, information can be transmitted through copper and fibre networks, cable networks, WiFi networks, LTE networks, UMTS networks and via satellite. This overlap of different technologies is a challenge for market definitions, and will be analysed in Section 5. This suggests that operators able to make bundled offers have an advantage over those operators using only one technology. For instance, operators that include WiFi in their package may be able to reduce congestion on wireless networks by offloading to WiFi. Another example is 'triple play', which may allow network operators to differentiate their offering from competitors by including pay-tv content.

The role of OTTs

The infrastructure side cannot be separated from content and services, as users derive utility from services delivered to them via access networks (see Section 4 of this report). Broadly, the vertical value chain involves four different types of players, all supplying complementary products: content and service providers; content and service aggregators; ISPs as local access network providers (abstracting from other players on the Internet)[3]; device makers. There are various elements of vertical integration. In particular, we observe vertical integration (and vertical contracting) between ISPs and network operators; vertical contracting between ISPs and content and service aggregators; vertical integration between content and service aggregators on the one hand and content and service providers on the other hand; vertical integration between device makers and content and service aggregators. Market power issues play a role at all layers. We observe that network effects are key factors, at least for content and service aggregators and ISPs. Network effects are present if a user's benefit is directly or indirectly enhanced by more users on the same network or platform. Direct network effects are present if a user benefits directly from the presence of more users. Facebook and other social networks are good examples of OTTs exhibiting direct network effects. An important benefit of users is to be able to interact with friends and to re-establish or maintain contacts with offline contacts. Thus, the more popular a particular social network, the more likely that any given friend or contact is subscribed. Similarly, voice and messaging apps exhibit direct network effects because

[3] We do not distinguish local access providers from ISPs as separate players. We note that a local access provider may not provide Internet services, while another party may do so and contract with the access provider. In the early days of the commercial Internet, we observed the success of ISPs such as AOL providing Internet services relying on the local access network of a telco provider.

a larger popularity implies that a random offline contact is more likely to be using the app. Many OTTs exhibit an indirect network effect, for example, booking portals. Sellers are attracted to engines with many potential buyers and buyers are attracted to booking portals with many sellers. Thus, there are cross-group external effects that are mediated by the portal. Here, network effects are indirect, as a buyer does not directly care about the amount of participation on the buyer side. However, since a large number of potential buyers attract many sellers, this example exhibits positive indirect network effects.

Currently, due to interoperability, for ISPs these indirect network effects mostly play out at the industry level, as opposed to being firm-specific. Price-induced network effects in mobile communications are a possible exception. These arise when off-net calls are more expensive than on-net calls with the consequence that, with the same prices, a larger network is more attractive than a smaller network, as a larger fraction of calls can be expected to be terminated on net. It is an empirical question to which extent such effects are still present today. For example, if consumers make most of their calls within a group of friends and family and they coordinate their subscription decision, the advantage of being on a bigger network, prices between networks for on-net calls being equal, can cancel out. Thus, a small network would not be at a disadvantage to a bigger one. In addition, while price-induced network effect may have been relevant in the past, with the spread of bundled offers including free voice and messaging (partly as a response to OTTs), these firm-specific network effects playing out at the consumer side completely disappear.

Unique service proposals by ISPs are another cause of firm-specific, indirect network effects for ISPs. For instance, if only one ISP can offer a certain quality of service and particular OTT applications rely on such a quality, this ISP features cross-group external effects giving rise to firm-specific indirect network effects. Similarly, the possibility to vertically integrate or exclusively contract Services gives rise to firm-specific indirect network effects.

Many OTTs allow interaction only among users who are subscribed to the particular service (e.g., messaging or VoIP provided by an OTT) or charge for calls to other users. Thus, due to very limited interoperability, network effects typically play out at the firm level for content and service aggregators and certain content and service providers. Whether network effects tend to lead to dominant players and affords market power shall be investigated in Section 6.

Observation 1: Firm-specific indirect network effects are present at the OTT level, while their presence at the ISP level depends on the characteristics of the ISP offer.

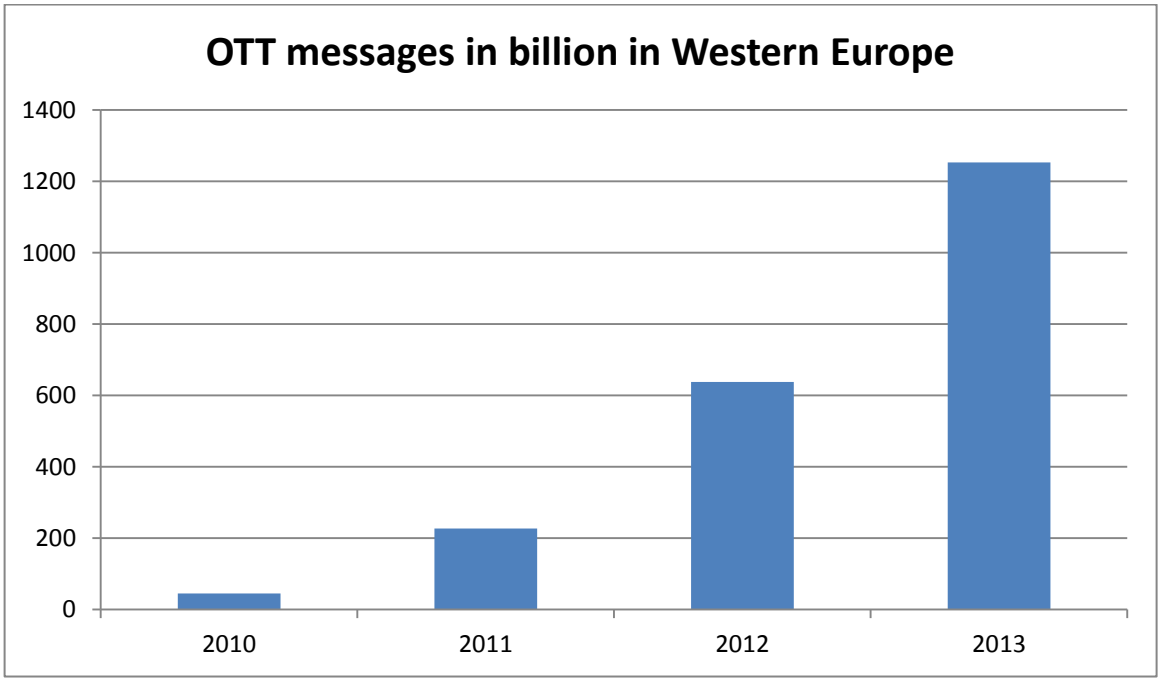
OTTs generate traffic for a number of different types of services on fixed and mobile networks. Noteworthy types of services are (1) communication, (2) real-time entertainment, (3) social networking, (4) marketplaces for downloads, (5) file sharing, (6) storage, (7) gaming, and (8) web

browsing. Some traffic is also due to network administration (e.g., DNS, ICMP, NTP, and SNMP) and tunnelling, which allows for remote access to some network resources or masks application identity. The different types of services are detailed below:

1. Communication services by OTTs mostly replace services by traditional providers of electronic communications, but also offer new and differentiated services such as video calls, which are not part of the conventional package of services offered by traditional providers. The associated applications, services and protocols allow for email, chat, voice and video communications as well as information sharing among users (e.g., photos). Particular OTTs include Skype, WhatsApp, iMessage, and FaceTime.
2. Real-time entertainment by OTTs contains on-demand entertainment of viewing or listening. Audio and video may be streamed or buffered. With buffering, material can be consumed with a small time lag. Specific streaming services are provided by Netflix, Hulu, YouTube and Spotify.
3. Social networking sites enable communication and information sharing among specified groups of users. Examples are Facebook, Twitter, LinkedIn, and Instagram.
4. On marketplaces, users can purchase and download media such as software, music, movies, and books. Examples are Apple iTunes, Google Android Marketplace, and Amazon.
5. Filesharing services offer peer-to-peer or newsgroups as distribution models. Examples are BitTorrent, eDonkey, and Gnutella.
6. Storage services involve data transfers using the File Transfer Protocol (FTP) and its derivatives. Many firms such as Dropbox, Google, Apple, and Microsoft as well as traditional providers of electronic communications offer such services to users.
7. Gaming services may be simply game downloads for game consoles from dedicated game platform providers and games for PC or mobile phones. Traffic may also stem from interactive online gaming.
8. A standard activity on the Internet is web browsing (HTTP, WAP browsing).

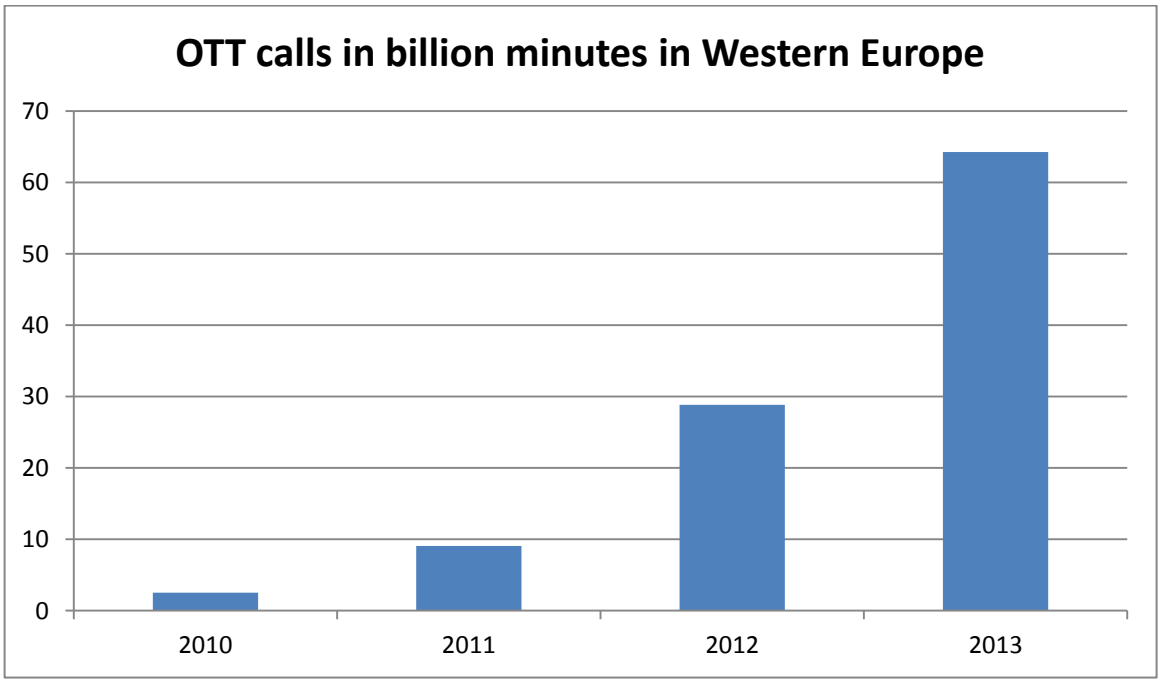
Communication services offered by OTTs are close substitutes to the corresponding services offered by telcos. The increase of messaging and call volumes has been dramatic over the last years. Using the data reported by Analysis Mason (2013), Figures 1 and 2 show the increase of traffic on smartphones for the period 2010 to 2013 in Western Europe. Volumes for telcos have been growing much more slowly. While OTT messaging traffic accounted for 8.31% of overall messaging traffic in 2010, this increased to 66.96% in 2013 in Western Europe (Analysis Mason, 2013).

Figure 1: OTT messages in Western Europe



Source: Analysis Mason, 2013

Figure 2: OTT calls in Western Europe



Source: Analysis Mason, 2013

Overall traffic data for Europe is reported by Sandvine (2014), and provides some interesting insights. In the second half of 2013, for peak period traffic on fixed networks, almost half of upstream traffic was generated by the file-sharing service BitTorrent (48.1%), which belongs to service type 5 in the above list. Other important sources of traffic volumes are YouTube (7.12%; service type 2), Skype (4.96%; service type 1), Facebook (3.54%; service type 3), Netflix (2.83%; service type 2), eDonkey (1.12%; service type 5), and Dropbox (1.12%; service type 6). Downstream traffic stems from the following applications, among others: Youtube (28.73%), BitTorrent (10.10%), Facebook (4.94%), and Netflix (3.45%).

Sandvine (2014) also reports peak-period traffic on mobile networks in Europe. The following OTT applications, among others, contribute to upstream traffic: Facebook, BitTorrent, Skype, YouTube, Dropbox, and Gmail. YouTube is the largest OTT contributor to downstream traffic with 20.62%. Other OTTs include Facebook (11.04%), BitTorrent (4.61%), and Skype (1.78%). YouTube and Facebook together contribute to more than 30% of all traffic on mobile networks. It is expected that video streaming and IP-based television will increase in traffic (OECD, 2014).

Traditional telcos appear to have 'lost' part of the revenue sources to content providers and aggregators, as some of them have developed substitute services. This is of concern for policy makers worried about the low level of investment in new telecom infrastructure in Europe, as a lack of cash flow or lower expected future profits reduces investments. OTTs strongly affect network operators. On top of the list in terms of traffic at the end of 2013 are Youtube, Facebook, Skype, Viber, and Instagram. The most important OTTs mentioned in terms of lost revenues for traditional SMS and MMS are WhatsApp, Apple iMessage, Facebook Messenger, Twitter and Instagram. As substitutes for traditional voice services, Skype, Google Voice / Hangouts, Apple Facetime, Viber, and WeChat are mentioned. In addition, WhatsApp announced the launch of its own voice service. We note that these lists are susceptible to change due to the dynamic development of the market and may depend on the particular country and operator. All these players belong to service types 1 and 3 and provide close substitutes to voice and SMS by traditional telcos. Traditional telcos may even propose and favourably treat the application of an OTT-player as in the case of E-Plus offering a prepaid SIM-card plan that exempts all traffic via WhatsApp from its data plan (see Fitchard, 2014). Here, WhatsApp effectively becomes the exclusive provider of IP-based communication for all users signing up to this pre-paid plan.[4]

[4] Similar in spirit are the agreements between Facebook and Orange in Eastern Europe and other parts of the world to exempt the social networking traffic from the latter's data plan. Another case in point is the agreement between Google and Orange in France to exempt Youtube traffic from the latter's data plan, as broadly reported in 2013. All these are examples of vertical contracting. They are subject to scrutiny by competition authorities in case they raise competition concerns.

Taking a closer look at OTTs, we observe that the business models of several of the leading OTTs are heterogeneous and some are likely to change over time. WhatsApp has, with 400 million users, the largest active user base worldwide. Membership is free for the first year and is US$ 0.99 per year thereafter. China-based WeChat has 355 million active users, and offers its services, which include messaging and voice, free of charge. Its only revenue stream at the moment comes from selling digital goods and services. Skype, with 300 million users worldwide, offers its services for free to other Skype users, but charges calls when terminating on phones, when not using Skype. Other OTTs such as LINE and Viber sell digital goods such as stickers. It is an open question whether a subscription model will prove successful.[5] In addition, OTTs may offer additional premium services for sale. Furthermore, it is an open question whether advertising revenues can be generated. Thus, while OTTs have attracted many users and affected electronic communication, it is difficult to forecast their business model in the long run.

Clearly, if telcos stop charging for voice calls and messaging, they no longer face a revenue loss from OTT substitutes. Then, when users communicate with each other via OTT services, substitution only occurs if these services offer a higher utility. In mobile telephony, several telcos have started to offer contracts that do not monetise voice calls and messaging. For those consumers who switched to such a contract, the OTT threat has already been accommodated, and, for those consumers, telcos have already incurred the revenue loss due to OTT entry.

Observation 2: The success of OTT apps for communication and messaging is making the traditional revenue model of telcos unsustainable.

A high level of heterogeneity marks the types of active contracts within the EU and across operators. Several examples illustrate this. As reported by Nomura (2014), Telefonica Germany introduced its 'Blue All-in' tariffs for its O2 brand in February 2013, which includes flat voice and SMS charges on all networks. By November 2013, less than one fifth of all subscribers had migrated to this net tariff. Similarly, less than one in seven subscribers of Vodafone had subscribed to 'Vodafone Red', which provides flat tariffs for voice calls and messaging. The fraction of users at T-Mobile with flat rates was at a similar level. The situation in Spain appears to be even more prone to change, where, by November 2013, 8% of all subscribers had adopted contracts that allow for flat voice charges. This implies that traditional telcos may face substantial revenue losses in the future because more consumers will no longer be willing to pay for voice calls and messaging. However, since OTT-services provide value to users the issue is more complex, as discussed in the economic analysis in Section 4.

In France, the situation is different, as Orange introduced flat voice tariffs as a default option on all contract offers in January 2012. According to Nomura (2014), 50 to 60% of subscribers had

[5] Information on subscriber numbers and current business models has been reported by Nomura (2014).

contracts featuring flat voice tariffs in the third quarter of 2013, with the migration predicted to be more or less completed in summer 2014. Italy is difficult to place in this landscape as the vast majority of users have pre-paid calling plans.

Lost revenues due to OTT messaging services are hard to calculate. By 2012, these messages had overtaken SMS messaging and network operators could only charge for the latter. While globally, the latter still appears to be increasing, albeit at a low rate, in some countries the volume has been reported to decline. According to Sale (2014), worldwide volume of OTT messages are estimated to be 10.3 trillion, which is much larger than the estimated volume of SMS messages at 6.5 trillion.

One further aspect of the role of some OTTs may affect the device layer. Some OTTs can be used only on particular devices (which rely on particular software platforms). For instance, WhatsApp can only be used on handheld devices. By contrast, Skype is supported on multiple platforms. This includes desktops (Windows and MacOS), mobile devices (Android, Blackberry, iOS, Windows Phone), video game consoles (Xbox), and cable boxes (Comcast).[6] This implies that Skype's services are available on devices that cannot handle traditional voice calls and messaging. In other words, there is convergence at the device level. To analyse substitution patterns, one thus has to take into account that users may simultaneously have multiple devices at their disposal.

OTTs of type 2 may also lead to revenue losses of cable providers and, in case they have their own streaming offers, of traditional telcos. The extent to which this will happen depends on the substitutability between linear and non-linear programming. In Europe, the extent to which OTTs of type 2 will make content offers leading to a high level of substitution away from linear programming is unclear. For the moment, a more relevant issue is that live streaming generates a lot of additional traffic, an issue to be discussed in the context of the net neutrality debate.

While there has been quite some hype about some successful OTTs, some traditional telcos are struggling to adapt to the new communication landscape. Financial markets, by and large, tend to subscribe to this view. They appear to view the prospects of large, mostly U.S.-based OTTs more favourably than those of many access infrastructure providers. This, perhaps, reflects two features of the players. While service provision can be easily scaled up to be provided globally, access infrastructure providers are limited by their physical network, unless they operate as virtual operators. While service and content providers often provide a unique product with no restriction on their pricing, electronic communications regulation in Europe ensures virtual operators have access to wholesale products at low prices. This restriction on the pricing of

[6] This information is reported in Nomura (2014).

wholesale products limits the mark-ups that network-based operators can charge to retail consumers and, thus, their profitability.

As follows from a look at market capitalisation, it seems that investors tend to bet their money on companies at the service and device layer, but at least in Europe, less so on infrastructure providers. In March 2014 some of the top IT and Internet companies in terms of market capitalisation were as follows (in US billion $; information from PwC, 2014): Apple 469, Google 409, Microsoft 318, Facebook 175, Amazon 166. While these companies have seen their market capitalisation increase, there are also examples of reductions (e.g., Yahoo). Looking at major European telco companies, market capitalisations are Vodafone 110, Deutsche Telekom 72, Telefonica 72, and Orange 39. More important than absolute values are changes over time. It is worth pointing out that most major Internet and content companies have seen their market capitalisation increase; the opposite is true for various European telco companies.

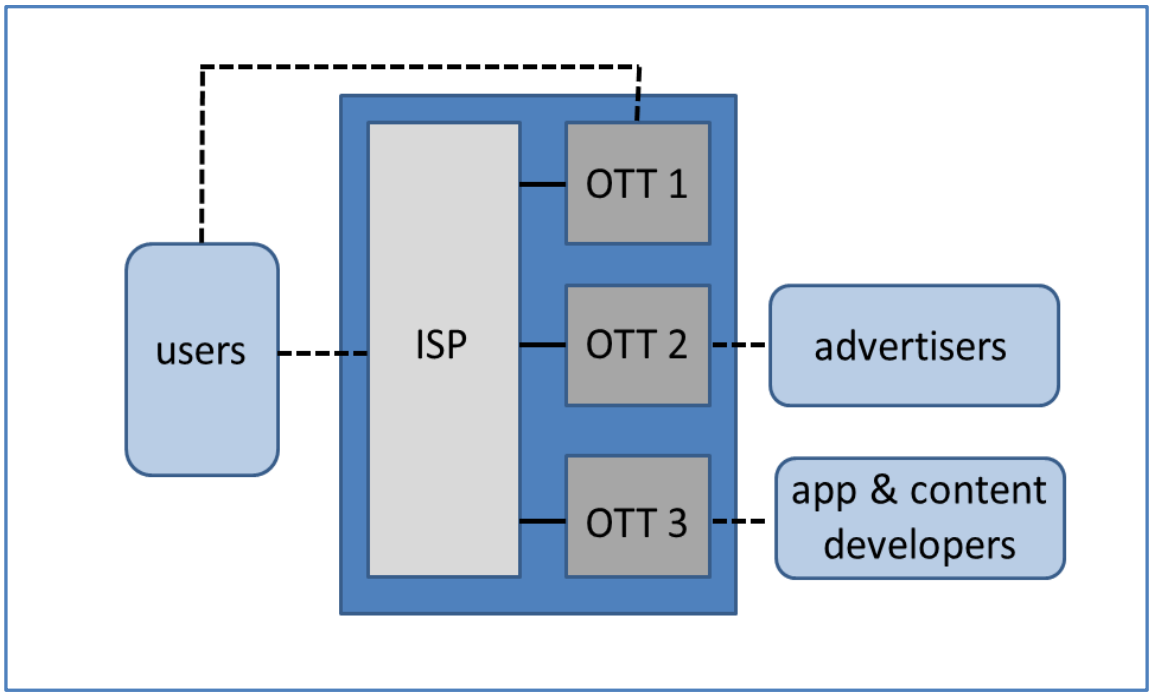
With these important changes in the landscape of ECMs in mind, it is important to explore the major economic forces and mechanisms at work. To be able to do so, it is useful to provide a conceptual framework for ECMs.

3. A stylised model of ECMs

Central features of today's electronic communications markets (ECMs) are complementarities between the different layers of the value chain, network effects in the provision of content and services, two-sided business models that partly involve indirect revenue generation, and a patchwork of regulated and unregulated segments of the market.

When subscribing to an ISP (e.g., a telco operator), users typically have in mind that they will consume services provided by the operator as well as those services available through OTTs. Figure 3 provides a stylised model of ECMs embedded into the wider market for communication, information and entertainment services. It depicts a single ISP carrying services and content by three different types of OTTs.

Figure 3: A stylised ECM



Source: Authors' own work

We note that OTT providers can deal directly with end users over networks whose owners are typically excluded from these transactions. Networks in the past assumed they would be providers of content. Indeed, some still try, such as BT acquiring sport rights. However, most of this delivery is coming from non-traditional operators that do not build the networks they rely on. This is particularly important for Netflix, or cloud services that put pressure on network capacity.

It is useful to distinguish between three idealised types of OTTs. OTT 1 offers services to users via the ISP. There are no other parties involved. Typically, the OTT charges users for its service, although a different contractual solution could be that the ISP offers the service of OTT 1 to users, charges users for this service, and pays the OTT. For instance, in cloud computing OTTs contract with users and offer storage services to users. Here, the typical revenue model of such an OTT is to charge users a subscription fee; there are no other revenue sources. A frequent strategy of such OTTs is to provide a limited service for free and offer a premium service for a fee (freemium' business models). We note that there are other online businesses that follow the same principle. For instance, dating sites and some social networking sites also rely on a subscription fees for premium services.[7] Recently, several media outlets such as newspapers have restricted their use to non-paying members and provide the full offering of the electronic version to subscribers (e.g., New York Times). In addition, Skype is an example of OTTs of type 1 as it offers a free service (between users that are both on Skype) alongside a paid-for service if someone wants to call any phone number.

OTTs of type 1 may gain market power due to switching costs and direct network effects.[8] In the case of storage services in the cloud, for instance, switching costs arise since it is time-consuming to transfer data from one cloud service provider to another. In addition, to the extent that sharing content among users requires the respective users to be subscribed to the same cloud service provider, a larger user base provides an advantage to such a provider compared to smaller providers. This is an instance of direct network effects.

OTTs of type 2 offer their services to users without direct payments. There is, however, a contractual relationship between the OTT and its users, as users typically have to allow the OTT to place cookies. OTTs provide a service and consumers provide revenues indirectly, by being exposed to advertising and by providing data that the OTT can use to improve the ad effectiveness. Hence, the OTT's revenue model consists of creating an audience first, followed by raising advertising revenues. Several Internet media have adopted this business model. Facebook, Google and Youtube all belong to this type of OTT player.

OTTs of type 2 are characterised by direct and indirect network effects. In addition, switching costs may be present. The important difference compared to OTTs of type 1 is the presence of indirect network effects. Users exert a positive external effect on advertisers because the latter are attracted by OTTs with a large user base. There are two reasons for this to happen. The first reason is rather obvious: a larger user base enhances potential demand. Second, a larger user

[7] An example for such a social networking site is LinkedIn, which provides a premium service at a fee. We note, however, that LinkedIn does not conform to this idealised type since it has additional revenue sources.

[8] The seminal academic contribution on competition with network effects is Katz (1985). More recently, platform-mediated indirect external effects have led to a number of important contributions, some of which are mentioned in Section 4. See also Church and Gandal (1993) and Church et al. (2008).

base allows advertisers to place any given ad more effectively, provided the OTT has technology in place that allows advertisers to better match their ads to prospective buyers. Here, a large user base gives more valuable consumer information to the OTT. There is also an external effect in the other direction, as users tend to dislike advertisers. Thus, advertisers exert a negative indirect external effect on users.

We note that in many examples, direct and indirect external effects are at work. For instance, on Youtube, a large user base attracts advertisers. In addition, a large user base attracts users themselves, as this gives rise to a large amount of user-generated content and a lot of information from its recommender system. A larger user base makes it more likely that, among available content, any given user can more easily find material they like. Search engines offer another example. Advertisers are attracted by a search engine with many users. In addition, any given user tends to prefer a search engine with a large user base, as this tends to give more useful search results in the organic search. Thus, positive direct external effects are also present. We note that this tends to lead to a highly concentrated market, but that this does not necessarily imply that one search engine enjoys a monopoly position, let alone that it could abuse it.

With the advancement of technology for targeting ads, the negative effect of advertising on viewers is limited and possibly even converted into a positive one. As the matching between ads and users is improved, fewer irrelevant ads reach users. Consequently, OTTs can become more efficient by reducing the overall ad exposure of a user, while maintaining the level of purchases triggered through advertising. In addition, since the ad is more likely to feature a product or service the user is interested in buying, the buyer is more likely to appreciate the advertising. If advertising exerts a positive external effect on viewers, we would classify this case as an OTT of type 3, which we describe next.

OTTs of type 3 connect app and content developers to users. Here, the OTT may charge those app and content developers for selling their product or service to users. Similarly, the OTT may charge users on behalf of the app and content developers. The latter then receive part of those revenues from the OTT. For example, users pay money to Apple iTunes. Apple takes a cut and pays the record companies the remainder. OTTs of type 3 include market places such as Amazon Marketplace as well as game platforms. Netflix can also be subsumed into this category (excluding content produced by it).

The key difference compared to OTTs of type 2, in terms of economic forces at play, is that the indirect external effects are positive in both directions. Users are attracted by OTTs with a large offering and app and content providers are attracted by OTTs with a large number of users.

OTTs of type 2 and type 3 are often two-sided platforms, as they must manage the matching between two distinct groups of participants.[9] ISPs are also two-sided platforms, as they provide the connection between users and OTTs. However, ISPs were traditionally not flexible in managing this interaction, as they could derive profits from the users alone, often due to regulations imposed on ISPs. Questioning the traditional business model of only charging users has in part led to the net neutrality debate, an issue we return to later. In addition, richer contract menu on the user side (combined with vertical contracting between OTTs and ISPs) reflects the attempt of ISPs to obtain additional revenue streams linked to differential use of OTT services.

There are four caveats to consider regarding Figure 3. Firstly, the figure does not capture the possibility that users can select ISPs. While this is often a subscription decision, a user may obtain even some short-term flexibility if they, for instance, can select among multiple WiFi connections.

Secondly, virtual network operators, which make use of (regulated) access products, can become ISPs. These observations imply that users can often choose among competing ISPs. Hence, there is competition at the retail level that limits the market power of ISPs vis-à-vis users.

Thirdly, to keep the representation simple and to reflect this report's focus on the interaction between OTTs and ISPs, the figure does not consider suppliers of devices, nor operating systems as players. However, we note that some OTTs are vertically integrated with device manufacturers and/or operating systems for these devices. Apple is an example of vertical integration of an OTT with a device and operating system. This may create market power issues at the OTT layer.

Finally, the above figure does not demonstrate that OTTs often have supranational or global offerings, whereas ISPs are typically active at the national or subnational level. This observation implies that the availability of the content or service of a dominant OTT may be critical for an ISP in attracting users. The availability of the infrastructure of a single ISP is less critical for a global OTT, as it only loses a fraction of its user base if an ISP were to block its content or services. This is likely to affect the bargaining power of the ISP vis-à-vis the OTT. Thus, market structure at the infrastructure and the content and service layer jointly determines profits and consumer welfare. To understand the market forces at play, it is useful to look at economic theory. This will allow us to derive some fundamental insights into the interplay of the two layers in two-sided markets.

[9] We refer to Evans and Noel (2005) and Evans and Schmalensee (2007) for informal introductions to platform markets.

4. Economic analysis of ECMs

Electronic communications markets have several economically significant characteristics, which are central to evaluating market outcomes. Firstly, the market exhibits direct and indirect external effects, which, depending on interoperability, play out at the operator, at the device, or at the industry layers. These external effects often give rise to two-sided platform markets in which a platform caters to two, or multiple, audiences. A two-sided platform then adjusts its business models to have both sides on board and to balance the demands.

Secondly, providers of electronic communications services have different revenue models, which may involve screening among different customers and different revenue sources.

Thirdly, as already mentioned in Section 3, these markets feature complementarities between services and access products along the value chain. If OTTs offer new services, they tend to provide additional value to the combination of services and infrastructure. However, they may deteriorate the quality of the alternative use of the infrastructure if they use valuable capacity. If OTTs offer perfectly substitute services to existing services bundled with the access product, absent quality improvements on existing services, they do not add value to the system and tend to reduce the incremental value of the offering of the ISP.[10]

Infrastructure and services as complements

A first very basic observation is that infrastructure and content are complements. In other words, users derive utility from a system consisting of Internet access and the content and services delivered over the Internet.

It is important to point out that it is not easy to disentangle the individual contribution to the social value of such a system. In particular, OTTs offering services rely on the infrastructure rolled out by telcos. To illustrate this point, suppose that a traditional connection with voice communication has a monetised social value of 50 Euro per user per month assuming that all users are subscribed. This social value is presumed to coincide with how much a user would be willing to pay. Suppose that OTTs introduce additional services such as social networking, streaming, gaming, etc., and that both a user's willingness to pay and the social value of the consumption of these services, including voice communications, is 200 Euro per user per month. One might therefore be inclined to say that content and service beyond traditional communication services has a social value of 150 Euro per user per month, while the social value of pure Internet access is 50 Euro per user per month. Thus, OTTs may claim that telcos should

[10] For a discussion of the relationship between ISPs and OTTs, see also Ganuza and Viecens (2013).

not receive anything from these 150 Euro. However, this is misleading since, in the absence of an Internet connection, willingness to pay and the social value of all those additional services is 0 Euro, as they are useless without an Internet connection. Thus, by making it possible that users can enjoy those services, telcos could argue that they, and not OTTs, created value.

This shows that the two providers of a system, consisting of Internet connection and services, jointly add value and that it is impossible to disentangle their individual contribution. The system has a social value of 200 Euro per user per month. Clearly, in such a system market, each commercial provider of a component of the system wants to make profits. To do so, each provider has to somehow charge for the use of its service.

Observation 3: In a systems market with Internet connection and services, the system generates a joint value to society. Thus, the societal value from adding an OTT app cannot be solely attributed to the respective OTT.

In markets in which different firms offer complementary services, economic inefficiencies due to pricing externalities arise. Here, each separate firm may charge a higher price than the price charged by a vertically integrated firm. This is because each separate firm does not internalise the revenue loss of the other firm from lower sales due to the price rise.[11] In the context of electronic communications services, this provides an efficiency argument for vertically integrating ISPs with service and content provision. For instance, if a profit-maximising ISP offers storage services, it internalises the effect of a price increase for storage services on broadband uptake. If an independent OTT provided this service instead, this OTT would not internalise the revenue loss suffered by the ISP due to lower broadband penetration. This pricing externality of vertically disintegrated services is an issue, whenever the corresponding OTT has market power. Note that this does not imply that independent OTT services are bad *per se*, as OTT may provide innovative services or may offer other benefits that an ISP does not provide. However, it does point to the need for public authorities to take pricing inefficiencies of OTTs with market power into account.

While this insight is important, it may not be immediately obvious how it applies to electronic communications markets in which two providers of complementary services obtain revenues on different sides of the market. This is the case if OTTs are of Type 2 or 3. Taking Facebook Messenger as an example, Messenger, together with an Internet connection, allows users to interact with each other. If Messenger is not available, users can send an SMS for which the telecom provider can charge. According to claims made by telco providers, the availability of Messenger eats into the ISPs' revenues. Revenue numbers in line with this claim were presented

[11] This pricing externality has already been pointed out by Cournot (1838). A variation is the double marginalisation result by Spengler (1950) in the context of vertical monopoly. Pricing externalities are also present under imperfect competition, albeit less pronounced.

in Section 2. However, Messenger does not charge users. Indeed this feature makes the service so attractive. Overall, users should feel happy about the additional service supplied by Messenger, and the question arises if ISPs can obtain higher revenues from Internet access as this service has become more attractive. Two economic mechanisms, however, make it difficult for an ISP to recover these lost revenues from the decrease of SMS volume. These mechanisms apply if ISPs have market power. In particular, these mechanisms also hold in the extreme if each ISP has monopoly power.

The first mechanism is due to a pricing externality that is present even if, in the observed market environment, the OTT decides not to charge users directly for its service and only obtains revenues from advertising and customer data profiling. This mechanism relies on network effects and a disutility from advertising and customer data profiling.

Revenue loss of ISPs: Numerical example 1

To make these two mechanisms explicit, we consider a numerical example. The example will illustrate that even though the ISP can adjust its pricing strategy in response to OTT entry, and charge more for Internet subscription, it may incur revenue losses. Suppose that there are 50 high-usage consumers and 50 low-usage consumers. Let us first postulate that high-usage consumers have a total willingness to pay of 75 Euro for the combined package of Internet access and messaging. For simplicity, we assume they are indifferent whether messaging is done by traditional SMS or via the OTT's messenger service. Low-usage consumers have a corresponding willingness to pay of 50 Euro for the combined package.

When the OTT is absent, a telco provider, which can only offer an 'all-you-can-eat' contract to all consumers, will charge 50 Euro in total for Internet access and messaging. Its revenues are 5,000 Euro (100 x 50 Euro). This results in higher revenues compared to charging 75 Euro, which would only attract the 50 high-usage customers. With the entry of the OTT, messenger becomes available and consumers switch to messenger, assuming that it is slightly more user-friendly. Suppose that the OTT makes revenue of 10 Euro per consumer from advertising and selling customer data. We assume here that, due to its global reach, superior information technology, or different data protection standards, this revenue source of the OTT is not available to the telco provider. Thus, if nothing else changed, the OTT would have revenue of 1,000 Euro, and the revenue of the ISP remains unchanged, as the latter continues to obtain 50 Euro per customer for Internet access. Hence, if the ISP used to charge for SMS traffic, this is no longer possible, but revenues can be kept more or less neutral if, in the presence of the OTT, the ISP charges a higher subscription fee.

It is notoriously difficult to apportion revenues of bundles of services provided jointly to individual services. However, let us suppose that, in the absence of the OTT, the telco provider obtained 25 Euro from providing the Internet connection and 25 Euro from messaging. If the

telco provider does not adjust its pricing, its revenue will be halved since consumers continue to pay for Internet access but not for messaging. However, in our setting, the telco provider may simply adjust its pricing strategy and charge 50 Euro for Internet service, and provide free messaging, which re-establishes revenue of 5,000 Euro.

However, as referred to above, messenger may be seen as a superior communication environment and, once in place, make SMS obsolete for some consumers. This may be the case if consumers first respond to messages on the app provided by the OTT, but less quickly to SMS. In the extreme, as everybody uses the app, sending any given message via the app becomes much more attractive than using SMS. For the sake of the argument, let us suppose that this is the case for all consumers. This makes the messenger app essential.[12]

While the OTT now provides an essential service, we presume that the ISP has the advantage of being able to commit to its price for Internet subscription. That is, it sets its price for users before the OTT chooses which prices to charge advertisers and, possibly, users. If the ISP set a price of 50 Euro for Internet access, the OTT would not set a price on the advertiser side only. Rather, it would optimally set, in addition, a price of up to 25 Euro on the consumer side or, similarly, engage in advertising or the sale of data that would constitute an implicit price of up to 25 Euro on the consumer side. In our numerical example, this would imply that only half of all consumers purchase the service, as the price for the bundle is now 75 Euro. This is profitable for the OTT as long as the joint revenue from advertising and pricing to half of all potential users is more than deriving only advertising revenue from all users. For an implicit price of 25 Euro, this is the case: (50 x 25 Euro) + (50 x 10 Euro) is larger than (100 x 10 Euro).

In such a situation, the ISP would suffer, as its revenues would be reduced to 50 x 50 Euro. Foreseeing this two-sided pricing strategy of the OTT, the ISP provider optimally adjusts its price and commits to charge 75 instead of 50 Euro. This means that broadband penetration is smaller than with a vertically integrated offer. Then, the ISP's revenues are 3,750 Euro (50 x 75 Euro) which is the best it can achieve in the presence of an independent OTT. The OTT now only derives revenues from advertising (50 x 10 Euro). Industry profits of both the ISP and OTT are less than under vertical integration, that is, in a situation in which the ISP provides the service itself. Half of the consumers leave the market and the other half obtains zero surplus instead of 25 Euro under vertical integration. Thus, consumer surplus and total surplus are also reduced. More generally, the ISP will not invest in high-quality connection, in particular to those consumers with a lower willingness to pay.

The above numerical example has illustrated the pricing externality that arises if firms with monopoly power set prices for complementary services independently, even if in the prevailing

[12] Essentiality arises more naturally if the OTT offers a service that lacks a substitute that can be offered by the ISP.

business models the ISP charges consumers, whereas the OTT decides to charge advertisers only. Hence, we have shown that pricing externalities also arise in two-sided pricing settings in which one of the firms decides to make revenues on one side of the market and the other firm makes revenues on the other side of the market. The argument may not appear to be directly applicable to the current market environment, but it is a first step in understanding that ISPs may be negatively affected by OTT offerings, even if they are fully flexible in adjusting their pricing strategies.

A different and arguably more relevant argument that telco providers' revenues are hurt by the entry of an OTT is based on the possibility to screen between different types of consumers. This second mechanism points to the loss of screening possibilities between different types of users that the ISP suffers, if an OTT offers a free service. This reduction in the ability to engage in targeted pricing is another reason for lower revenues by the ISPs.

Revenue loss of ISPs: Numerical example 2

We return to the previous numerical example and now postulate that the network provider is able to extract all surplus from consumers, in the absence of OTT services, based on metering call and SMS traffic. For metering to be feasible, consumers with a higher willingness to pay also have a larger demand for calls and messages. With full surplus extraction, the ISP's revenues are 6,250 Euro: (50 x 75 Euro) + (50 x 50 Euro). With the entry of the OTT, this screening possibility no longer exists because messenger replaces SMS. In addition, download caps do not help here, as SMS does not generate much traffic relative to other services. Therefore, the network provider makes a profit of 5,000 Euro. Hence, the network provider's revenues are reduced since it loses its ability to extract surplus through screening between high-usage and low-usage consumers. In general, the welfare and consumer surplus consequences are unclear. In the present example, welfare and consumer surplus increase with the entry of the OTT. However, this takes the level of infrastructure investment by the network provider as given. The entry of the OTT reduces the ISP's expected surplus from each additional consumer. Taking everything else as given, this reduces the incentives of an ISP to invest in infrastructure.[13]

This second mechanisms shows that SMS and voice calls can no longer be used as metering devices by the ISP once substitute OTT services are available. This unambiguously reduces ISP profits. If the ISP reacts in its rollout decision, then consumers and society may be worse off under OTT entry.

[13] Returning to the situation in which the OTT's services become essential, with consumer screening and in the absence of the OTT, the network provider has revenue of 6,250 Euro (as we have seen above). However, with the entry of the OTT, the network provider's revenues are only 3,750 Euro (50 x 75 Euro). Here the revenue reduction results from the combination of the pricing externality and the lack of screening possibilities.

Observation 4: OTT entry may lead to an essentiality of the OTT app or may undermine the ISP's metering of consumer calls and messages. In both cases, the ISP's profits suffer and undermine the ISP's investment incentives.

Pricing in two-sided platforms

As pointed out in Section 3, ISPs can be considered as two-sided platforms. If technological constraints and regulatory restrictions are absent, they can charge prices at the user and at the content provider side. For the sake of simplicity, we now only focus on the ISP and suppose that there are many small content and service providers. Hence, if these providers are small, they may be able to exploit their market power when interacting with users, but they cannot individually affect the pricing of the ISP.

A recent and very influential academic literature with seminal papers by Rochet and Tirole (2003) and Armstrong (2006) has developed pricing implications in such platform markets.[14] Consider the case of a monopoly ISP, which is the simplest case to consider. It has practical relevance when ISPs have market power. By choosing prices on both sides of the market, the ISP as a two-sided platform can manage indirect external effects. A profit-maximising monopoly ISP uses a modified monopoly pricing formula. The standard monopoly pricing formula states that the Lerner index, which is the per-unit profit margin as a percentage of the price, is equal to the inverse price elasticity of demand, which expresses the price sensitivity of end users. A profit-maximising two-sided monopoly platform uses a modified pricing formula on each side of the market. Essentially, per-unit costs are adjusted downward by the external effect exerted on the other side. Thus, the stronger the indirect network effect, the lower the price. The socially optimal prices would indeed be lower than monopoly prices and would take into account the indirect network effects.

Price structure: numerical example 1

Some of the results on the optimal price structure of a monopoly platform can be illustrated by a numerical example. Suppose that the platform charges a transaction price p_O per user to the OTTs and a price p_U per application to the user. For simplicity, we postulate that users have demand for all available apps and OTTs want to cater to all users. Each OTT offers a single app. Hence, the ISP generates interaction between all active OTTs and users and its revenues are the sum of price times number of participants on each side: $(p_O + p_U)n_O n_U$, where n_U is the number of users and n_O is the number of available applications. In a first numerical example,

[14] For an informal discussion how two-sided market theory can be used to better understand the functioning of real-world platform markets, see Evans and Schmalensee (2007). A formal introduction into two-sided platform markets is provided by Belleflamme and Peitz (2010, chapter 22).

there are three users, each deriving a value of 2 Euro per month.[15] There are three OTTs. The OTTs derive different values per user. OTT 1 derives a value of 1 Euro per user per month, OTT 2 a value of 2 Euro per user per month and OTT 3 a value of 3 Euro per user per month. Hence, the average value of OTTs is 2 Euro, which is the same value as on the user side. Despite the same average value, the two market sides respond differently to price changes. If the platform were to set prices slightly below 2 Euro on both sides, all three users would participate, whereas only OTTs 2 and 3 would be active. With these prices, the ISP would make around 24 Euro per month. However, if the ISP reduces the price on the OTT-side to slightly less than 1 Euro, all OTTs will be active. While one may think that carrying two apps by charging 2 Euro for each of them is more profitable than carrying all three by charging 1 Euro each, this neglects the fact that a lower price leads to an overall higher trading volume which makes it possible for the ISP to obtain additional revenues on the user side. Overall, the ISP is better off to charge this lower price, as each of the three apps is used by all three users. Since the ISP obtains, per transaction, 1 Euro from each OTT and 2 Euro from each user the ISP has an overall revenue of 27 Euro.

This example illustrates that the values from interactions derived on the two sides, affect the optimal price strategy. In the example, since OTTs respond to the price reduction, whereas users would not do so for the same reduction, it is here profitable for the ISP to set a lower price for OTTs. In the reverse situation, users would pay a lower price. More generally, a price change on one side affects demand on both sides. Thus, to understand for example, the price set for consumers, demand conditions on both sides of the market have to be taken into account. This also applies to a competition authority or a regulator investigating a certain market with two-sided interactions. If this is confirmed, the user side cannot be considered in isolation.

The strength of the cross-group external effect plays a decisive role. The external effect from OTTs to users is particularly strong if users place a high value on the apps. This implies that it is important for an ISP to host many apps, which implies that the ISP should offer OTTs favourable terms to become active. If, by contrast, OTTs derive a high value from users, for example, because this allows them to obtain large advertising revenues, optimally the ISP may offer more attractive terms to users and less attractive terms to OTTs.

Price structure: numerical example 2

To illustrate the fact that cross-group external effects may even lead to zero pricing on one side of the market, we provide a numerical example with six OTTs and six users. Each user obtains a value of 6 Euro per month from each app. OTTs obtain different values: OTT 6 a value 3 Euro, OTT 5 of 2 Euro, and so forth until OTT 1 obtains a value of minus 2 Euro. This implies that even if the ISP does not charge OTTs, OTTs 1 and 2 will not be active on the market. If the ISP cannot subsidise OTTs, it will not charge OTTs and earn revenue only on the user side. It charges every

[15] This and the following numerical example are adopted from Peitz (2006).

user slightly less than 6 Euro per month; all users and four OTTs become active on the ISP and revenues are 144 Euro (24 x 6 Euro) per month. However, if the ISP can subsidise OTTs in this example it will optimally do so: the optimal price structure is to charge every user 6 Euro per available app and to give 1 Euro per user to every active app. Then, all six users and five OTTs contract via the ISP. For the 30 interactions between OTTs and users, the ISP receives 6 Euro per app per month from users and gives 1 Euro per user per month to OTTs. The ISP's revenue is 150 Euro per month, which is larger than 144 Euro.

While monopoly pricing leads, of course, to higher prices than socially optimal pricing, the important insight from two-sided market analysis is that the monopolist's price structure is aligned to the socially optimal one. In particular, the side that exerts the stronger external effect on the other side tends to be charged a lower price. As illustrated in the above numerical example, this may even imply that one side of the market is subsidised, such that the price does not cover the cost of engaging an additional participant on this side. Subsidisation is profitable as it allows for the extraction of larger revenues on the other side. Competition authorities may suspect predatory intent if a price is negative or, more generally, below its average variable cost. However, in two-sided markets, cross-subsidisation simply reflects the management of cross-group external effects. Prohibiting such a negative price not only reduces the ISP's revenue but is also socially costly. This goes hand in hand with high prices on the other side. Such high prices are not necessarily excessive and simply reflect the optimal price structure to manage app availability and user participation.

Observation 5: ISPs can possibly manage the interaction between OTTs and users. The unregulated price structure chosen by the ISP may then resemble the socially optimal price structure, as the ISP internalizes cross-group externalities. In particular, neither prices below cost nor very high prices are indications of anti-competitive behaviour.

In the extreme case that OTTs can extract the full surplus from every interaction with a user, users do not care about the amount of apps available. Thus, OTTs do not exert a positive external effect on users. In such a situation, it is likely that users receive a low price, while the ISP charges a large mark-up on the OTT side. It is also important to note that the socially optimal solution feature high prices on the content and service provider side.

We would therefore expect that in a mature market in which OTTs know their customers well and have found means to monetise interactions, there is a downward pressure on the price the ISP charges users. By contrast, in the early days when content and service providers offer their product for free, the ISP's optimal price structure tends to feature rather high prices on the user side. We would therefore expect that, as the market matures, fully flexible prices of the ISP become lower on the user side, while higher on the content and service provider side. As long as

pricing restriction is imposed by net neutrality regulation (see below), we will not, however, observe such adjustment of the price structure.

In many market environments, users face a discrete choice between two or more ISPs. This means that they sign a contract with an ISP and make use of apps via this ISP. This introduces competition between ISPs for users. By contrast, OTTs can provide their apps on multiple ISPs. This implies that users are particularly valuable for ISPs, since an additional user gained is a loss for competitors. By contrast, OTTs may refuse to make their app available on a particular ISP. However, the decision by the OTT on whether to be active on a different ISP is separate. Hence, conditional on user participation, each ISP exerts monopoly power on the OTT side. Such a market environment has been called one of 'competitive bottlenecks'. It tends to lead to low prices for users and high prices for OTTs. While low prices are attractive to users, their overall surplus may be limited due to the limited availability of apps. The socially optimal price structure is not achieved under competition between ISPs since the latter are too concerned about user participation.

Due to cross-group external effects, the price structure under competition may be socially less desirable than under a monopoly ISP. The reason is that under competition, platforms fight for the users who face a discrete choice, leading to prices which, considering total welfare, are relatively too low on that side. Hence, the standard notion that competition is good for users and society can be challenged in the presence of significant cross-group external effects.[16]

Economic insights in the net neutrality debate

The debate over the question of net neutrality (NN) is rich and much has been written about it. NN can mean many things. Economists have focused on four potential meanings: (1) no pricing of (the user's) ISP on the content provider side; (2) no prioritised access (at a positive price); (3) no non-price discrimination based on type of content or service; and (4) no vertical foreclosure.

In the public debate, some net neutrality proponents have said in the past that the users' ISPs should be prohibited from charging the content provider side on the ground that users already pay for the Internet access and that charging content providers would amount to charging prices twice. This view is a manifestation of a lack of economic understanding since platform markets are characterised by the possibility of a platform to charge prices on both sides. Also, as elaborated on above, it is often in the interest of the platform to set a positive price on both sides of the market and, under some conditions, this privately optimal price structure is similar to the socially optimal one in structure, if not in levels. Therefore, imposing a zero pricing rule

[16] For a textbook treatment of the effects of platform competition on market outcomes, see Belleflamme and Peitz (2010).

without further economic analysis violates economic principles and should therefore be discarded as a policy option.

Although there is no consensus among academics and experts on one definition of NN, from an economic viewpoint the issue is essentially that broadband technology allows for web traffic management techniques. These techniques can potentially be used for quality differentiation of data packets and use of termination charges for network traffic. From this angle, then, NN is mainly a data treatment and pricing issue. Hence, although ideology and principles play an important role, the debate is ultimately caused by the redistributive issues of regulating the Internet and mandating NN. While the debate is complex, the following schematisation can be useful.

On the one side are those who propose regulation that bans discrimination of data packets and guarantees 'open' and equal access to the net no matter what the type of content (or 'openists'). On the other side are those who believe that the Internet needs no price or access regulation and will develop better by letting the market forces operate freely (or 'deregulationists'). While this distinction is obviously too simplistic, it is often reported in the media and is useful to organize the debate.

Both sides have asked relevant questions. One of the main stances of 'openists' is that NN rules are needed to protect the innovation of small start-up content providers. Within their ranks may be tomorrow's giants like Google, Facebook or Youtube, companies that started from a smart idea and went on to change the Internet and people's lives.[17] Innovation at the 'edge' of the network is one of the defining features of the Internet and discrimination constitutes a potential harm to it.

The main counter argument of 'deregulationists' is based on the need of Internet service providers to receive appropriate remuneration for the use of the infrastructure. This is seen as the best way to guarantee investment for maintenance and expansion of the capacity of the network, with a particular emphasis on access networks. This concern is becoming more prominent due to the increasing diffusion of bandwidth-intensive applications and predictions of their further diffusion and demand for it in the future. In addition, with limited capacity of access networks and interconnection points, prioritisation and pricing can guarantee a more efficient use of available capacities.

Two prominent academic studies provide partial support to the view that net neutrality regulation that forces ISPs to treat all traffic equally (at zero price on the content provider side) is socially desirable. According to an analysis by Choi and Kim (2010), using a queuing model for

[17] The recent policy report by the OECD on digital television appears to be broadly in line with this 'openist' view (OECD, 2014).

traffic, prioritised access serves is a rent-extraction device. This means that the ISP engages in second-degree price discrimination with ambiguous results on social welfare, particularly when including investment incentives in the analysis. Economides and Hermalin (2012) consider a fixed pipe of traffic that can be transmitted in times of congestion. Traffic is distinguished by how time-sensitive the associated service is. In addition, introducing prioritised access at a price serves as a price-discrimination device. Users adjust their consumption to the level of congestion; in particular, their demand falls with congestion. The authors establish conditions under which net neutrality is welfare superior to tiering, at least in the short run with a fixed pipe. However, it is difficult to link these conditions to the real world. We conclude that both formal analyses provide ambiguous welfare results and, therefore, do not provide strong support for either of the two stances.

An important limitation of their analyses is that they do not focus on high-volume and time-insensitive traffic, for example, traffic through the file-sharing service BitTorrent, or Netflix. Such traffic tends to lead to congestion. Delaying such traffic would cause little social costs. However, under the best-effort principle, which treats all traffic symmetrically, a differential treatment is not possible. As documented in Section 2, in times of peak traffic, such high-volume, time-insensitive traffic contributes significantly to the total load and thus makes other more valuable uses unsustainable.

Numerical example on net neutrality

A numerical example illustrates the insight that a priority lane increases social welfare compared to net neutrality, which requires zero price and equal treatment of all traffic. Suppose that a particular connection has a capacity of 200 units. Consider a period of peak traffic in which there is a request to transmit 150 units of time-sensitive traffic and 150 units of time-insensitive traffic. Suppose that each unit of delivered traffic generates a user value of 1 Euro. If time-sensitive traffic is delayed, the user value drops to zero, while it only drops to 0.9 Euro for time-insensitive traffic. We postulate that the different delivery requests arrive in random order. Under net neutrality, all traffic is treated equally. On average, one third of each type of traffic is not delivered, since 100 units in total cannot be delivered. Hence, the expected user value is 245 Euro: (200 x 1 Euro) + (50 x 0.9 Euro). This is also total surplus under net neutrality.

Suppose now that the ISP introduces prioritised delivery with a price between 7 and 33 Euro cents delivered on the priority lane.[18] In this case, the sender of time-insensitive traffic does not

[18] If the price for prioritised access is below 7 Euro cents, any single provider of time-insensitive traffic has an incentive to buy prioritised access, as its expected value is 1 Euro minus the price for prioritised access, whereas it is (1 Euro x 1/3) + (0.9 Euro x 2/3) if not buying prioritised access. If the price is above 33 Euro cents, a sufficiently large provider of time-sensitive traffic has an incentive not to buy prioritised access: a provider generating all time-sensitive traffic obtains an expected value of (1 Euro x 2/3) for each unit if it decides not to buy prioritised access for any of its traffic.

have an incentive to pay for prioritised access, whereas a sender of time-sensitive traffic always has such an incentive. Since 100 units of time-insensitive traffic cannot be delivered on time, total surplus is 290 Euro: (200 x 1 Euro) + (100 x 0.9 Euro). Hence, prioritised access increases total surplus and generates revenue for the ISP on the OTT side.

This numerical example provides an insight of general validity.

Observation 6: If telcos are allowed to introduce and charge for prioritized delivery, scarce capacity is allocated more efficiently among different types of content.

The numerical example has illustrated that allowing for tiering increases welfare as the gain from prioritized delivery of time-sensitive traffic dominates the potential loss from non-prioritized delivery of time-insensitive traffic. Whether users are better off in this example depends on the price of the priority lane, the possibility of the OTT to pass on to consumers the price it has to pay for prioritised delivery, and the price adjustment of the ISP on the user side. Even if the OTT fully passes on the delivery price it has to pay to consumers, and the ISP does not lower the price of the Internet connection charged to users, end-user surplus might increase. In the numerical example, this happens if the ISP's revenue from prioritised delivery is less than 45 Euro. This is the case if the price for priority delivery of one unit is less than 30 cents. In such a situation, users and the ISP are better off. While OTTs with time-insensitive traffic are slightly worse off, OTTs with time-sensitive traffic are much better off.

In the net neutrality debate, several important points based on recent results from economic theory deserve attention.

Firstly, should the ISP charge an OTT for the traffic it generates, one expects that the subscription fees paid by end users will decrease, other things being equal. This result is due to a 'waterbed' effect. This is immediately obvious if the ISP is competitive, since its overall profits, from every source, are kept down to a normal level by the competitive process. However, it also extends to markets in which ISPs enjoy some degree of market power.[19] Indeed, economic theory suggests that users tend to face very low prices if they choose one among several competing broadband offers, whereas OTTs can offer their apps via multiple ISPs.[20] The decrease in subscription fees is expected because of the two-sided nature of the market. This would be to the advantage of end users, an aspect that is sometimes forgotten in the policy debate.

[19] Genakos and Valletti (2011, 2014) provide empirical evidence of the waterbed effect in mobile telecoms.
[20] For a formal treatment, see Armstrong (2006).

In practice, the subscription fee decrease may not materialise, if the ISP changes its network investment to support the data traffic increase. However, this is a dynamic argument that we address below.

Secondly, in a situation where end users have access to only one ISP, that is, they 'single home' in the economics jargon, the ISP – whether competitive or not – will have a tendency to overcharge the OTT for 'termination'. However this result disappears if end-users 'multi-home', that is, the OTT can reach the same consumer on multiple platforms, and also if the OTT has bargaining power, in that it can negotiate its termination fees with the ISP.

Thirdly, pricing for prioritised access increases economic efficiency in times of binding capacity limits, as illustrated above. We note that different apps place different demands on access networks. Hence, offering different delivery qualities is socially valuable. While traffic management and uniform positive prices at the content provider side have ambiguous results on the use of transmission capacity, prioritised access is particularly successful in channelling different types of traffic according to their time-sensitivity. Introducing a priority lane also provides incentives to content providers to adjust traffic volume and traffic sensitivity according to economic value.[21] In particular, content providers have stronger incentives to adjust traffic volume to scarcity, to invest in compression technologies and to reduce the time sensitivity through adequate buffering at the user's premises.

The fourth point is that the fear that abandoning NN will lead to many applications being blocked or priced out by the ISP is largely overstated. As presented earlier, if the ISP's platform provides less functionality, its appeal will largely decrease and therefore fewer end users will be willing to pay much for access to such platform.

A further point is that the NN debate is also a debate about which type of investments should be given more importance. [22] Here, it is useful to think that abandoning the strict notion of NN will lead to a dual system, whereby ISPs still offer OTTs a 'free' service based on best-effort treatment of packets, alongside a paid-for 'priority lane' which guarantees a better quality, for example, faster delivery and/or lower congestion. A switch from the net neutrality regime to a regime that allows ISPs to charge OTTs for prioritisation would increase investment in broadband capacity. This is because the discriminatory regime allows ISPs to extract additional revenues from the OTTs through priority fees. Interestingly, innovation in services can also increase. Some highly congestion-sensitive applications, which were left out of the market under net neutrality, would enter when a priority lane is proposed. Particular quality of service (QoS) may be needed to make innovative services feasible. Guaranteed delivery quality may be a key

[21] These arguments are formally developed in Peitz and Schuett (2014).
[22] For a formal treatment of the analysis, see Bourreau, Kourandi, and Valletti (2014).

factor to make major, socially valuable innovations in areas such as e-learning, e-mobility and e-health happen at the content and service level.

A sixth point is that if one distinguishes between 'small' and 'large' content providers, a switch to the discriminatory regime can hurt the small providers more than the large ones. However, the latter typically account for a larger portion of total welfare. If society has strong preferences towards 'small' content providers, then there is a stronger support for NN regulation, despite its negative impact on overall welfare. However, in the current debate this view is not very meaningful, as large content providers can deliver their content by building their own content delivery networks and establishing interconnection close to the users' premises. Thus, prioritised access, at a positive price, appears to be of particular importance for small providers when there are capacity constraints at some switches.

Finally, a discriminatory regime might bring forth a risk of quality degradation of content providers' traffic, in the 'slow lane', by ISPs. Whereas this risk is absent under rules implementing a strict notion of net neutrality, an ISP might benefit from degrading the quality of the non-priority lane in order to extract higher profits from the priority lane. Therefore, if regulation of traffic quality is too complex and/or costly for the regulatory authority to carry out, keeping the current net neutrality regime might be a solution to avoid quality degradation of content providers' traffic. Otherwise, economic analysis suggests that a switch to a discriminatory regime would be welfare-improving, while requiring some monitoring of traffic quality.

Given the limited number of alleged cases of quality degradation, it appears that *ex post* measures are preferable to *ex ante* regulation. In particular, competition authorities have the power to intervene in vertical foreclosure cases, that is, in situations in which an ISP blocks the content or services of a particular OTT, or discriminatorily decreases its quality. With a revised regime on net neutrality, this assessment may change and thus the threat of regulatory intervention should be sustained. However, as ISPs are allowed to charge for prioritised access in a liberalised regime, foreclosure incentives tend to be reduced compared to the status quo. Thus, we do not expect *ex ante* regulation to become an attractive policy option.

Observation 7: For a proper application of competition policy and a correct design of regulatory policy, the substitutability of services, complementarities along the value chain, and cross-group external effects need to be properly taken into account.

In light of the importance of investment and innovation at both layers, particular attention has to be devoted to the effects of competition policy and regulatory interventions on the rent distribution among the various stakeholders. As a result, dynamic implications with respect to

investment incentives and market penetration have to be derived. There is a possibility that allowing ISPs to engage in more flexible pricing while offering different quality of service, will increase investment both for ISPs and for CPs. ISPs will be able to find revenue sources from those CPs that might ask for particular solutions, such as guaranteed quality. Interestingly, CPs might also invest more as they will be able to deliver services that precisely rely on having particular solutions, such as a guaranteed quality. With a strict notion of NN that does not allow for differential pricing and quality, such services would not emerge, with lower investments on the side of CP developers.

5. Market definition

To assess market power and eventually consider the type of regulatory intervention needed, it is customary to first define the relevant market, that is, the set of products that consumers find substitutable for each other.

A commonly used tool for market definition in a traditional market is the so-called 'Small-But-Significant-Non-Transitory Increase-in-Price Test' (SSNIP test), which defines the market as the smallest set of substitute products, such that a substantial (usually, five or ten percent) and non-transitory (usually, one year) price increase by a hypothetical monopolist would be profitable.

Starting from a set of candidate products for the relevant market, the SSNIP test is implemented by simulating a price increase above the competitive level by a hypothetical monopolist who owns only one product. As long as that leads to losses in profits, the test progressively increases the number of products owned by the monopolist. When profits are not estimated to decrease following an SSNIP by the hypothetical monopolist, the set of products owned by the monopolist in the last simulation constitutes the relevant market.

In merger and abuse of dominance cases, it is important to assess which services are substitutes to one another. For instance, an SSNIP test for mobile voice services must consider all relevant substitution possibilities. In particular, consumers may switch to OTT services if they experience a price increase for traditional voice services. In addition, they may substitute parts of their calls for messages, either SMS or substitute services by OTTs such as WhatsApp. In general, this is consistent with the view expressed by the European Commission: "product characteristics and intended use are insufficient to show whether two products are demand substitutes […] differences in product characteristics are not in themselves sufficient to exclude demand substitutability […]."[23] However, in the context of ECMs this needs further adaptation.

As referred to in the introduction, different technologies can belong to the same market. From a user's perspective, it is often irrelevant if a connection to the Internet is established through copper and fibre networks, cable networks, WiFi networks, LTE networks, UMTS networks or via satellite. Demand substitutability should be the key criterion for market definition. If multiple technologies can be used for the same purpose, all providers of these different technologies are competing in the same market. A possible complication is that a user may change his or her location. This will immediately affect the available offerings. Thus, geographic and inter-temporal demand substitutability for electronic communication services will have to be taken into account for market definition.

[23] Commission Notice on the definition of relevant markets for the purposes of Community competition law, 197 OJ C 372/5, paragraph 36.

Further interesting and complex issues arise when attempting to extend the SSNIP test to ECMs, taking into account that these involve complementarities and various externalities. In particular, as ISPs are platforms that sit in between end users and OTTs, a related question is how to apply an SSNIP test to a two-sided market.[24] Firstly, given that in a two-sided market firms can, at least in principle, set two prices, one on each side of the market, the question is which price the hypothetical monopolist should be raising. Secondly, given that in a two-sided market, demands on both sides are linked through cross-group external effects, and thus profits depend on the overall price structure, the issue is whether one should consider profits on one or on both sides of the market.

These issues have been addressed in some cases both by the EU Commission and by national competition authorities.[25] However, a clear conceptual framework for incorporating the economic specificities of two-sided markets into the market definition exercise has not yet evolved.[26]

One might be tempted to argue that, when one side of the market does not pay, only one market should be defined, namely, the one with paying customers. According to this view, in the context of telcos for instance, the market should be defined at the user's level and OTTs should not be included, as they generate no revenues for telcos. However, we will show this reasoning is flawed due to cross-group external effects and may lead to inappropriate conclusions.[27]

To fix ideas, it may be useful to consider market definition in linear television. Television channels are platforms catering to consumers on one side and advertisers on the other, if they contain some advertising. In this context, many competition authorities distinguish between Pay-TV and free-to-air TV as separate markets, as the two adopt different business models. As such, they represent a choice of the firm and not a feature of the market itself. The point here is that the choice of the financing mechanism is not necessarily linked to demand substitutability between any pair of Pay-TV and free-to-air TV channels. Suppose that Pay-TV and free-to-air TV do not compete for advertisers. Nevertheless, if there is demand substitutability on the viewer

[24] For a discussion of how to apply merger analysis to platform markets, see Evans and Noel (2008).
[25] For an analysis of the relevant case law, see Filistrucchi et al. (2014).
[26] For suggestions see, inter alia, Filistrucchi et al. (2014), Thépot (2013) and Zingales (2013) with the following suggestion: "… the most reasonable approach seems for competition authorities to make a *prima facie* product-specific market definition, involving a description of the market participants and the sources of competitive constraints and no more than a cursory look at market shares, namely in order to forego dominance inquiries in case of too little market power by the allegedly dominant company. In order to avoid type II errors (under-enforcement), such *prima facie* markets should be drawn as narrowly as possible, identifying the smallest subset of products for which there is consumer demand. Only at a second state would the picture become clearer, as authorities look into the scope for the exercise of market power, its relationship with potential entrants and whether any submarkets can be identified based on this particular relationship […]" (Zingales, 2013, p. 37).
[27] See Filistrucchi et al. (2014).

side, they should be put in the same relevant market. In this case, Pay-TV competes with free-to-air TV for viewers even though the latter does not charge viewers directly.

It is only if Pay-TV and free-to-air TV are not substitutes for viewers, that the type of business model might be relevant to assess supply substitutability. Even if free-to-air TV and Pay-TV were not substitutes for viewers, arguably, one should take into account the other side of the market, even in a case involving Pay-TV stations. In fact, the decision by a Pay-TV station whether to rely on advertising financing or not is likely to depend on an assessment of the costs and benefits of advertising financing. The costs would then depend on the degree of advertising aversion of TV viewers, that is, the strength of the indirect external effect exerted by advertisers on viewers. The benefits would depend on the degree of competition on the advertising market for the viewers of Pay-TV. Hence, Pay-TV could be competing for advertisers with free-to-air TV. In this case, both Pay-TV and free-to-air TV should be put in the same relevant market.

An investigation into the demand substitutability is also needed to answer the question whether SMS and OTT messaging belong to the same market. Here it is not relevant that OTT messaging apps often do not directly charge customers. The key question is the substitutability between the services from the viewpoint of consumers to decide whether both types of services belong to the same market.

Take the case of a two-sided platform, with sides A and B linked by positive cross-group external effects. The application of a one-sided SSNIP test on side A would only account for the direct effect that a price increase will have on the demand and profits of side A. It will not account for the fact that a reduction of the number of customers on side A is likely to lead to a reduction of the number of customers on side B. Given this, if the price on side B is kept constant, there would also be a loss in profits on side B. It would also not envisage the fact that the smaller number of customers on side B will in turn reduce the demand of side A, and so on. Hence, it would also underestimate the loss in profits on side A. Positive cross-group external effects between the different sides of the platform reduce the profitability of any price increase. There is always at least one positive cross-group external effect present. Therefore, the risk of applying a standard SSNIP test, which does not account for feedback effects, is that in such cases the market will be defined too narrowly. The SSNIP test in a two-sided market should therefore take into account the changes in profits on both sides of the market and all feedback between demands on the two sides of the market following the hypothetical monopolist's rise in price.

Observation 8: As ISPs and OTTs often operate as two-sided platforms, even when they only charge on one side, a proper SSNIP test in ECMs must include cross-group externalities, as they give rise to feedback effects. The risk of ignoring those feedback effects is an overly narrow definition of the market.

As another analogy, consider the case of a car market, where brand A is vertically integrated and brand B is not. If the question is whether brand A and brand B are substitutes for consumers it would not make sense to have a test that applies only to brand A and one that applies only to brand B. Both market definitions would be too narrow. The SSNIP test in a single-sided market aims at measuring substitutability irrespective of the organisation of the vertical market structure. A two-sided SSNIP test should do likewise. Hence, in ECMs, it would be wrong to start with market definitions based on the level of integration of a particular player, which is again a business model decision of a particular player and not a market. The initial starting point of any analysis must always be the end users and the final services they seek.

We are not arguing here that OTTs and telcos are necessarily in the same market. It depends on circumstances. However, it is always essential to begin by asking what the set of products that end users want is. Having access to an ISP, per se, does not carry much value. The value is brought by the system containing communication and content services. Following current practice regarding after-markets,[28] one could define a single 'system' market. This comprises both the primary market for connectivity and the secondary market for content use. This is because it is usually the case that consumers will want the system and anticipate the utility from the secondary market when buying the primary product. Primary and secondary products then belong to the same system market.

If an element of a system is in perfectly competitive supply, it is immaterial whether it is included in the system market. Inclusion of both products is relevant in case firms with market power provide them. Integration of several elements, and vertical contracting, thus should be analysed from this perspective. We refer back to the economic analysis in Section 4.

[28] An after-market is any market where customers who buy one product or service (the 'primary market') are likely to buy a related, follow-on product (the 'secondary market'). Printers and toner give a textbook example.

6. Assessing market power

The next step from a competition policy perspective, but also from a regulatory perspective (establishing regulatory obligations), is to consider whether any particular operator or service provider holds a position of market power in the market. Market power broadly reflects the ability of a firm to behave in ways that are detrimental to the interests of end users (for example, by setting excessive prices, delivering poor quality, or failing to innovate) or that foreclose the market to more effective competition.

End-users sign contracts with providers of electronic communication networks. These contracts include certain data and voice packages, with various allowances up to 'all-you-can-eat' contracts. Beyond simple access products, it is useful to distinguish between several markets that users access. In particular:

- Search and marketplaces. This includes general and vertical search engines and market places;
- Social communication services. This includes social networks, chat, VoIP, and instant messaging;
- Media services, including broadcasting, connected TV, video streaming;
- Data services including storage and processing of data.

A more complete and detailed list of services has been provided in Section 2. On the other side of the ECM, we can distinguish between different OTT roles in advertising. An OTT may become an advertising platform. It may engage in customer data profiling, selling profiling data to advertisers or marketers. Or, it may engage in content selling, where the OTT operates as a content aggregator, broadcaster or video service provider. In the first two cases, the OTT is of type 2, according to the classification in Section 3. In the third case, it is of type 3.

Among the many services that providers of electronic communication networks offer, the following are of particular relevance:

- One-to-one communication at the receiving party. In Europe, the price for these services is typically zero;
- One-to-one communication by the initiating party. Traditional telcos charge for their service;
- Data sent;
- Data received.

To be able to enjoy these services, the end-user has to have network access. This may be provided by a third party, such as a free spot at a café or an employer, or may be a personal

subscription. The end-user needs a device that can be connected via an access technology. Many devices are now able to deal with various access technologies.

Due to the services offered by application providers, traditional revenue sources from one-to-one communications are falling, as documented in Section 2. In particular, there are several substitutes for traditional SMS and MMS, as well as traditional voice services. Substitutes for traditional SMS and MMS include WhatsApp (recently taken over by Facebook), Apple iMessage, Facebook Messenger, Twitter, and Instagram. Substitutes for traditional voice services include Skype, Google Voice, Apple Facetime, and Viber. WhatsApp has announced plans to launch a voice service.

Clearly, with different types of operators being able to provide the same range of services, convergence should be expected to facilitate competition amongst a greater range of technologies. Largely, this is reflected in changing market definitions, with markets potentially becoming wider. This in itself would tend to reduce the scope for any particular firm to enjoy market power. For instance, among traditional telcos, widening the market to include both fixed and mobile broadband services would suggest that no single provider would enjoy market power in the retail market. This will both remove the need for promoting retail competition by imposing access obligations, and increase the likelihood that wholesale services will be supplied on commercial terms even without such obligations in place.

Observation 9: The increasing importance of OTT services can augment or reduce SMP of some broadband suppliers and means that attention will need to shift to also include those who are able to supply such services.

The importance of service availability for network choice means that vertical relations between network operators and service providers will have an important bearing on the assessment of market power. In particular, arrangements under which content or specific applications that might be characterised as ‘must-have’ would be provided exclusively over a particular network, would need to be assessed very carefully.

For instance, if market power of a broadband provider is linked to exclusive access to an OTT service, the source of this market power is not control over network infrastructure, but rather the nature of the service. Indeed, any advantage that a network operator may gain from being able to provide exclusive access to a particular type of content may have been competed away in the process of signing an exclusive agreement with the content provider. For example, a broadband provider that is in a position to offer exclusive video-on-demand access to premium movies might face reduced competition from other broadband providers and may be able to sustain higher prices, but the content provider will ultimately appropriate much of this benefit.

Any regulatory access obligation aimed at addressing this problem would have to be linked to access to the service. For example, an obligation to provide network access imposed on a broadband operator who enjoys market power because it provides exclusive access to on-demand premium video services would do little to rectify the problem. An effective competitor would require access to content.

In the case of OTTs, for instance, web-based messaging services may have little pricing power on the consumer side, but when bundled with other services, such as social networking, this messaging service provides OTTs with information about the users, which can then be used to improve the targeting of advertising. This may give large OTTs an advantage over competitors that results in increased revenues on the advertiser side. This asymmetry implies that the traditional revenue model of telcos for SMS may break down and cannot be replaced by an advertising-based model, unless they are allowed and able to earn revenue from the information about users they obtain.[29]

In the presence of bundling strategies, the assessment of market power needs to consider whether and how other providers can replicate specific bundles with sufficient ease. Where bundles are difficult to replicate, competition concerns may arise. Replicability will need to be assessed on a case-by-case basis, and conclusions cannot easily be generalised. Particular competition policy concerns may arise where service bundles constitute separate markets, and the bundle includes components that are not under the remit of regulators. In the context of developing markets, mobile payment services and other business-enabling services as part of a bundle may deserve scrutiny by competition authorities.

The greatest challenge in dealing with bundling and exclusive vertical arrangements is that these practices can be beneficial and create substantial efficiencies. Bundling, for example, may simply allow the supplier to share some of the cost savings from economies of scale with its customers. It may reduce transaction costs and respond to customer preferences for a single bill or an integrated service proposal. It may avoid double marginalisation, and allow firms to engage in output-increasing price discrimination, broadening access to services. Whether a particular form of behaviour is anti-competitive or beneficial can only be established in the specific context. Thus, it is questionable to address such practices through regulatory policy. They should instead be scrutinised *ex post* by competition law.

While the analysis has been focusing on the interplay between ISPs and OTT services, another relevant layer at which market power concerns arise are operating systems, which, as in the

[29] Therefore, telcos may want to make use of the services by OTTs. However, to be able (indirectly) monetize on their consumers, they would need to able to charge OTTs for accessing their subscriber base. By signing agreements e.g. about preinstallation of certain services or differential treatment within a calling plans, telcos would be in such a position.

case of Apple, are vertically integrated with devices. We observe that Apple, Google, and Microsoft are not only important OTT players, but also control mobile operating systems, albeit with varying degree of success. Thus, anti-competitive practices may occur at the operating system level and the behaviour of OS players is another issue on which competition authorities must keep a watchful eye. In particular, vertical integration between OS and OTT services may raise competition concerns.

Beyond the adjustment of market boundaries, however, there may be changes in the nature of competition that need to be considered in any market power assessment. In many markets that involve network rollout, substantial investments have been, or will need to be, undertaken in order to serve the growing demand for bandwidth. Investments in new capacity tend to be lumpy, and create substantial excess capacity that will only be slowly filled. This is the case in the rolling out of fiber. The presence of such excess capacity may discourage further investment in competing infrastructure, as investments are largely sunk and the investor can expect to meet strong competition from those who have already built out their networks. For the same reason, however, where competing infrastructures are in place, competition can be expected to be intense even if the market is highly concentrated. Those who have invested in infrastructure have strong incentives to attract customers and fill existing capacity as additional business can be accommodated at little or no additional cost. This means that NRAs may have to give particular attention to the timing of investments and the plans for bringing new capacity on stream. They may also have to be wary about capacity expansion that discourages investment by competing infrastructure providers, but at the same time acknowledge that in geographic areas or market segments where facilities-based competition exists, concerns about market power should be greatly reduced.

7. Regulation of OTTs and providers of ECS

In this section, we question the current state of regulation that treats traditional telcos as providers of electronic communication services (ECS), with an unclear role of OTTs. The European definition of an electronic communication service is as follows: "Electronic communications service means a service normally provided for remuneration which consists wholly or mainly in the conveyance of signals on electronic communications networks, including telecommunications services and transmission services in networks used for broadcasting, but exclude services providing, or exercising editorial control over, content transmitted using electronic communications networks and services; it does not include information society services, as defined in Article 1 of Directive 98/34/EC, which do not consist wholly or mainly in the conveyance of signals on electronic communications networks" (see Art. 2c Directive 2002/21/EC). The qualification of services as ECS serves as a starting point for the imposition of regulatory measures within the 'New Regulatory Framework' (NRF). This is composed of the Framework Directive 2002/21/EC and the four specific directives accompanying it, namely Directive 97/66/EC, the Access Directive 2002/19/EC, the Authorisation Directive 2002/20/EC and the Universal Service Directive 2002/22/EC. There has been considerable uncertainty as to whether, and under what preconditions, OTTs may also qualify as ECSs so that the specific obligations defined in the NRF may also be imposed on them.

In answering this question, the specific purpose of the New Regulatory Framework must be taken into account. The NRF's core concern is to promote the transformation of markets for the transmission of electronic signals from their original status as state monopolies to competition. Thereby it establishes a genuine internal market for electronic communications, eventually governed solely by competition law (see, inter alia, rec. 5 of the preamble to Directive 2009/140 and UPC v. Hilversum, at para. 45). Hence, the purpose of the NRF is essentially limited to market power issues in the transmission of electronic signals, and it pursues a deregulatory purpose. Its purpose does not extend to addressing market power issues, or other regulatory issues, linked to content. Such issues may need to be addressed otherwise (see below).

A first ambiguity in the scope of application of the NRF to OTTs is introduced by the requirement that ECS may only be services that are normally provided for remuneration. As discussed earlier, OTT-services may be provided freely to one group of customers, to gain a large customer base that attracts, inter alia, advertisers on the other side of the platform market. Should such a business model exclude the qualification of services as ECS? The Framework Directive does not provide for an explanation of the remuneration requirement. However, the wording in Art. 2c Framework Directive coincides with the definition of services in Art. 57 TFEU, which outlines the scope of application of the freedom to provide services (Art. 56 TFEU). It is well accepted that

"services" within this context comprise all services that constitute an "economic activity".[30] With a view to the comprehensive goal of the freedom to provide services, the concept has been broadly defined. Early on, the ECJ found that the transmission of television signals qualifies as a provision of services.[31] In Steymann, the ECJ confirmed that services formally provided for free would qualify as an economic activity when they constitute an indirect quid pro quo for another service provided in return[32]. This finding suggests that the provision of personal data would likewise be qualified as a relevant economic consideration. In addition, the fact that the provision of services to customers on one side of the market is cross-subsidised by parties active on the other side will not exclude the qualification of services as an economic activity.

Secondly, the definition of an ECS requires that the relevant services consist wholly or mainly in the conveyance of signals on electronic communications networks. It does not extend to services exercising editorial control over content transmitted over electronic communications networks. This part of the definition reflects the NRF's clear distinction between the production and the transmission of content. As the ECJ has recently put it, "[c]ontent and transmission are covered by different measures which pursue their own objectives".[33] The obligations set out in the NRF are meant to address regulatory needs linked to the transmission of services, no more.

The exact meaning of this requirement has recently been addressed in two ECJ judgments, namely in UPC Netherland BV v. Gemeente Hilversum and in UPC v. Nemzeti Média.[34] UPC is a commercial company supplying packages of radio and audiovisual broadcast services to subscribers. UPC does not produce these programmes itself, nor does it exercise any editorial responsibility over their content (UPC Netherlands, at para. 42).

In UPC Netherland BV v. Gemeente Hilversum, the ECJ was called upon to decide whether the supply of a basic cable package on such basis was to be considered an ECS within the meaning of Art. 2(c) Framework Directive, even if the remuneration charged to subscribers included payments to broadcasters and royalties paid to copyright collecting societies, apart from transmission costs.

While in UPC Netherland BV v. Gemeente Hilversum, the cable infrastructure used for transmission was owned by UPC, UPC v. Nemzeti Média involved a somewhat different factual setting. Here, radio and audiovisual services were transmitted to subscribers via satellite – an infrastructure not owned by UPC. In addition, access to the relevant programmes was subject to

[30] ECJ 12.12.1974, 36/74, ECR 1974, 1405, at para. 4 – Walrave.
[31] ECJ 155/73, ECR 1973, 409, at para. 6 – Sacchi.
[32] ECJ 5.10.1988, 196/87, ECR 1988, 6159, at para. 11 et seq. – Steymann.
[33] ECJ, 7 November 2013, C-518/11 at para. 41 – UPC Netherland BV; ECJ 30 April 2014, C-475/12, at para. 36 – UPC/Nemzeti Média.
[34] ECJ, 7 November 2013, C-518/11 – UPC Netherland BV; ECJ 30 April 2014, C-475/12 – UPC/Nemzeti Média.

a conditional access system. Again, the ECJ was asked to decide whether such circumstances would exclude the qualification of the service provided as an ECS.

In both cases, the ECJ found that the provision of a package of radio and audiovisual services to subscribers with no editorial control being exercised by UPC qualifies as an ECS. The fact that customers take out a subscription to gain access to defined content is irrelevant in this regard. The fact that the costs charged by UPC to subscribers incorporated payments made to broadcasting channels and royalties paid to copyright collecting societies, that is, payments for content and not for transmission alone, did not preclude UPC's services from being characterised as ECS. According to the ECJ, any other interpretation would have undermined the effectiveness of the NRF's provisions and compromised the achievement of its objectives to promote the establishment of an internal market and the evolution from *ex ante* regulation towards competition law. The dividing line between transmission services and 'audiovisual media services' (Art. 1(1)(a)(i) of the Audiovisual Media Services Directive) is not the transmission of specific content itself, but rather the exercise of editorial responsibility and control. As AG Kokott has put it:

"[…] whether a service is excluded from the definition of electronic communications services does not depend on whether it consists of the provision of content but on whether it includes the *production* of content and/or editorial responsibility" (UPC v. Nemzeti Média, at para. 35)

According to the purpose of the NRF, the qualification as ECS was valid irrespective of the mode of transmission chosen (cable in UPC v. Hilversum, at para. 44; satellite in UPC v. Nemzeti Média, at para. 41). In view of the convergence of the telecommunications, media and information technology sectors, the European legislator has sought to create a single regulatory framework for all transmission networks and services (see rec. 5 Framework Directive). The fact that in UPC v. Nemzeti Média, signals were transmitted by means of an infrastructure that did not belong to UPC was not relevant. "All that matters in that regard is that UPC is responsible vis-à-vis the end-users for transmission of the signal which ensures that they are supplied with the service to which they have subscribed" (para. 43).

Moreover, the qualification of services as ECS is not excluded by the fact that access to content is protected by a conditional access system within the meaning of Art. 2(f) of the Framework Directive. Directive 98/84 lays down specific rules for conditional access systems, but when attached to the provision of radio or broadcasting services, the conditional access system remains an ancillary element (UPC v. Nemzeti Média, at para. 52). The service continues to consist mainly in the conveyance of signals on electronic communications networks, and therefore remains an ECS. To summarise, while these decisions apply to broadcasting content, they do show that any OTT services can fall inside or outside the NRF, depending on the specific circumstances of the case.

Observation 10: Based on recent judgments, the qualification of OTT services as ECS, subject to the regulation of the NRF, will have to be determined case by case.

Whenever the transmission of content not produced or edited by the OTT itself is a core element of the service offered, the NRF will apply. Where OTTs offer access to content produced or edited by itself, the relevant services will not be considered to consist wholly or mainly in the conveyance of signals on electronic communications networks. Such services will lie outside the scope of the NRF. The same is true in cases where an OTT merely provides software to be installed and used by the end-users or access to data stored on its own servers, but does not take responsibility for the transmission of data itself. In these regards, no extensive interpretation of the NRF content-related issues of significant market power is to be expected. Rather, the limited purpose of the NRF prevails. The goal is to deal with transmission-related positions of market power and with these alone. As market power issues raised by OTT services are not congruent with transmission-related positions of market power, and in particular not with the legacy monopoly power of transmission networks that lies at the heart of the NRF, the NRF is unlikely to address the relevant problems comprehensively and adequately. Rather, OTTs require an independent and separate analysis as to when and why an intervention is needed and whether competition law alone can address relevant issues of market power or where regulatory intervention may be justified. We will now consider the economic case for both types of interventions.

Adjusting the regulation of telcos

The presence of OTTs and various two-sided issues will almost inevitably widen the market definition that applies to traditional telcos. The implication is that it will be less likely to find market power, and therefore less intervention will be needed. Certainly, given that various business models will coexist, we expect that it will become increasingly unsustainable to intervene *ex post*. Competition authorities, correctly, should only look at possible abuses that are less likely to arise when multiple operators compete in various ways against each other. This leaves the question of whether *ex ante* regulatory interventions are also less warranted in newly defined and wider markets that encompass both telcos and OTTs. In general, the answer has to be yes. However, we need to point out that, in practice, the objectives of regulation and competition policy are not necessarily aligned. In particular, because multi-sided markets are characterised by many forms of externalities, it follows from basic economic theory that even competitive markets do not deliver efficient solutions, precisely because externalities are not fully taken into account. In addition, consumer protection issues outside the scope of competition policy, such as consumer unawareness about the use of the data they provide, may need to be addressed through regulation.

The job of *ex post* competition policy is not to correct externalities. Hence, it almost never tries to impose the 'right' prices. Instead, it limits its role at investigating whether anti-competitive behaviour arises. This is a different matter with regulators. Regulatory authorities sometimes have the power to fix specific prices, and tend to look at externalities as well. Precisely because it will be more difficult to intervene *ex post*, it is also fundamental to see if there are any endemic market failures that can be more effectively addressed with *ex ante* measures. However, it was noted earlier that regulators should avoid applying one-sided logic to these matters. They should apply a correct two-sided view to inform any *ex ante* intervention, as it may be more difficult to fix problems associated with externalities *ex post*.

One area that will still be under the scrutiny of regulators relates to call termination. Until now, regardless of how competitive the market for subscribers was, operators would enjoy market power over the setting of the rates for terminating calls on their individual networks. This bottleneck is pervasive and peculiar to telecoms. Indeed, market definition has been stretched to define termination on every single individual network as a relevant market, with the consequence that termination rates are regulated almost everywhere. Are OTTs changing this situation? The answer is possibly yes. The whole idea of termination regulation rests on the impossibility for callers to find substitution possibilities when calling people on other networks. This is because subscribers typically single-home. That is, they subscribe to only one operator. With increased multi-homing, and especially with applications that allow one to contact a person without having to pay termination charges, for example Skype or WhatsApp, the bottleneck nature of termination is called into question. There are more opportunities for arbitrage among services with and without termination rates. If callers can find alternative ways to contact the same person, at a given moment, over multiple devices or via multiple applications, there is a much-reduced reason to regulate termination rates, as telcos would no longer have the ability to raise their termination rates above competitive levels. Of course, this is an empirical question that needs to be assessed carefully. Perhaps those who can multi-home are relevant, but they still do not sufficiently constrain the behaviour of the average subscriber that does not multi-home. We are nevertheless raising the important point that the landscape has changed, and regulators should refine their analysis to take into account these new forms of substitutability. If it is empirically demonstrated that termination has lost its bottleneck feature, it has to follow that regulation of termination rates should also be withdrawn. Notice that, as regulation is currently in place, this may be affecting current substitution patterns and, therefore, an empirical test should be carefully crafted.

Another issue that specifically affects the regulation of telcos *vis-à-vis* the OTTs concerns bandwidth throttling and limited download and upload plans. Of course, one will always want to make sure that these methods are not abused, and, therefore, should be subject to *ex post* competition law. However, any blank *ex ante* prohibition is a serious impediment to economic

efficiency. As long as there is full transparency, these are legitimate forms of price discrimination. For instance, there is nothing wrong, say, if an operator offers two plans, A and B, where plan A is cheaper but blocks some, perhaps bandwidth intensive, apps while plan B is more expensive but also allows them. To the extent that consumers clearly understand this, and are not fooled *ex post*, this is a legitimate pricing policy that can actually enlarge participation of end users as it caters for potentially heterogeneous consumer preferences. These legitimate forms of price discrimination are particularly unproblematic in those situations where consumers can easily switch among ISPs.

Regulating OTTs?

The purpose of this section is to highlight areas where current regulations are either asymmetric or do not seem to capture the changes that have occurred the ECM landscape. While we are far from being able to deliver a unified and coherent framework due to the novelty of the changes, it is important to acknowledge the need for some basic re-thinking. The various topics that follow next will, it is hoped, inform future steps that regulatory authorities will want to take.

The first issue concerns data protection and data security. Telecommunications laws protect the information supplied by individuals. However, they do not apply to OTTs as long as they are not legally providing electronic communications services. There is little economic rationale, however, to treating OTTs offering communication services differently. Regulation should be symmetric. Thus, regulation should explicitly state that the privacy and data security requirements for providers of public electronic communication services apply equally to OTTs. We do not think that such a change will be an impediment to OTTs to monetise on data collection and analysis, but it would put all players on a level playing field.

A second area to be discussed relates to interoperability. Communication services of telcos are interoperable, in the sense that everyone can communicate with everyone else. Indeed, this industry-level network effect is the very basis for the historical success and growth of telecommunications. Instead, OTTs often lack interoperability. Is this a concern to be addressed? Moreover, how can it be addressed? By withdrawing obligations of interoperability between telcos or by introducing such an obligation for OTTs? Perhaps an intermediate solution could be envisaged such that an interoperability obligation is imposed only on networks with significant market power. Clearly, more analysis is required here. It is indeed possible to have a dual system where some operators are more ‘open’ while others are ‘closed’. This could be a source of differentiation. We are far from having drawn conclusions on this issue, but it is at least worth reintroducing in the interoperability debate, the issue of symmetric regulation and that of transparency. There should be symmetric treatment under similar circumstances. The challenge is thus to define what similar circumstances should mean when OTTs offer substitute services to

telcos, which are forced to offer interoperability. Additionally, consumers should always be informed about the extent to which the various services and apps can or cannot communicate without restrictions.

A third issue concerns discriminatory access to OTT services. Such an issue can arise if an OTT service operates as a platform. A case in point is the discussion of search neutrality of search engines such as Google. The question here is whether firms with market power introduce bias in search results in favour of vertically integrated services, and whether that constitutes an anti-competitive practice. Another example is the favouring of certain apps or content by the operating system, for example, of smart phones. Both issues can be addressed through competition law if the practice is deemed anti-competitive, similar to vertical issues in the context of the net neutrality debate. If a problem appears to be long lasting and cannot be addressed with competition policy instruments, regulation remains a last resort.

The fourth issue is related to emergency calls. Current European regulation specifies: "Providers of electronic communications services that allow calls should ensure that their customers are adequately informed as to whether or not access to emergency services is provided and of any limitation on service (such as a limitation on the provision of caller location information or the routing of emergency calls)."[35]

In general, emergency services have to be provided by all providers of electronic communication services: "Member States should ensure that undertakings providing end-users with an electronic communications service designed for originating calls through a number or numbers in a national telephone numbering plan provide reliable and accurate access to emergency services, taking into account national specifications and criteria. Network-independent undertakings may not have control over networks and may not be able to ensure that emergency calls made through their service are routed with the same reliability, as they may not be able to guarantee service availability, given that problems related to infrastructure are not under their control. For network-independent undertakings, caller location information may not always be technically feasible. Once internationally-recognised standards ensuring accurate and reliable routing and connection to the emergency services are in place, network-independent undertakings should also fulfil the obligations related to caller location information at a level comparable to that required of other undertakings." [36] Thus, it remains an obligation of telco operators as providers of electronic communication services, but not of OTTs. As telcos control the infrastructure, some argument remains that such an arrangement is still appropriate. Emergency calls are essentially a bundled product of provision of access to the electronic

[35] Directive 2009/136/EC of the European Parliament and of the Council of 25 November 2009, paragraph 23.
[36] Directive 2009/136/EC of the European Parliament and of the Council of 25 November 2009, paragraph 40.

communication system and is offered even if other services are not available to a particular user.

By analogy, as it took some years for cellular services to offer full access to all types of calls, it is worth asking if it is just a matter of time until OTTs will be asked to supply emergency services too, except for a telephone number, which loses its relevance. However, an important difference is that cellular services come together with a network, physical or virtual. OTT services, however, are applications that run over networks of third parties without a contractual relationship between OTT and end-user ISP. While mobile OTT services might not be able to, and thus cannot be obligated to, implement a stand-alone emergency call, they may still be required to integrate functionality as an input to facilitate emergency calls. This could be done through an industry standard or through solutions developed by network operators.

Of further relevance is the question of which devices have to offer emergency calls. For instance, while a game console may handle messaging it is not clear whether to impose a provision that emergency calls can be made with such a device. Thus, the issue of which type of devices are required to carry which functionality needs to be addressed by regulators. In a dynamic market, regulators need to be careful not to impose functionalities too early. However, to give an example, if the market for smart watches develops and leads some people to, at least temporarily, substitute smartphone for smartwatches, the issue of emergency calls needs to be addressed for this type of device.

8. Main lessons and future challenges

To summarise, this report has provided:

- a conceptual framework of multi-layer competition in electronic communication, media, and content markets that addresses the question of how to define the relevant market;
- a conceptual analysis of the effects of regulatory interventions on unregulated parts of the value chain in electronic communications and the distribution of rents among various actors;
- an economic analysis of net neutrality regulation;
- a formulation of potential pitfalls when applying traditional competition tools to platform markets;
- an exploration of dynamic effects of policy interventions, including *ex ante* regulation and *ex post* competition policy interventions;
- guidelines on how competition rules need to be developed to take indirect network effects properly into account;
- a legal analysis of the applicability of European regulation of Electronic Communication Markets to OTTs.

The report's findings are useful to structure the debate about future electronic communications regulation including OTTs and the application of competition law in Internet access and content markets. The project has taken stock of current economic thinking and provided evidence on recent development. It has elaborated on the merits of an integrated approach considering the interplay of competition policy and regulatory policy. To do so, possible misalignments between private and public incentives have been identified, which included dynamic considerations.

The report has identified a fundamental complementary relationship between infrastructure products (Internet connectivity) on the one hand and content including media and software applications on the other. If, for instance, regulation limits the pricing of ISPs, most rents accrue to users and content providers. While this appears to be socially desirable in the short term, it may lead to inefficiently low investments in infrastructure.

Limiting the pricing of the ISP may even lead to welfare losses in the short term. This insight is relevant to the current net neutrality debate. A restrictive interpretation of net neutrality, according to which content providers are not allowed to pay for prioritised delivery, constrains the business model of ISPs and typically leads to a socially insufficient use of scarce existing network capacity. In addition, it may lead to socially insufficient investment in network infrastructure as well as content and software applications. However, one must also admit that dynamic implications are complex and, therefore, difficult pin down.

Since ISPs include particular services in their offerings, the relationship between ISPs and OTTs is characterised by complementary and substitute relationships. Direct and indirect externalities on OTT platforms may give rise to market power in several segments of the OTT layer. To the extent that the corresponding OTT services compete with services offered by ISPs requires a reassessment of regulatory policies in case these ISP services are subject to regulation. Here, symmetric regulation implies that regulatory restrictions are either withdrawn from the ISPs or imposed on OTTs. Potentially anti-competitive practices should be addressed case-by-case relying on *ex post* competition law and not on regulatory intervention, unless a systematic market failure is diagnosed that is better addressed through *ex ante* regulatory measures.

This report is a reliable and non-partisan evaluation of approaches to define markets and assess market power in electronic communications including content and service providers. This should be particularly timely since content and application providers on the Internet have attracted a lot of funding and some have become global players with substantial market power.

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