Centre on Regulation in Europe

Improving network and digital industries regulation

A Fresh Look at Zero-Rating

Final Report

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Executive summary

Zero-rating denotes a tariff (or tariff option) that allows end-users to access certain content without being charged for the corresponding data consumption. Zero-rating is usually exercised in mobile networks, where it is common to sell end-user tariffs that entail a certain data allowance. Zero-rated content then does not count against that allowance. Throttling may be, but is not necessarily, part of a zero-rated offer. Here, the practice of throttling can be seen as an Internet Service Provider (ISP)'s enforcement of a speed limit for some or all types of service.

When zero-rating offers are considered on a case-by-case basis, an *economic* assessment of different zero-rating practices appears to be of first-order importance. The report provides such an economic assessment in the context of mobile internet access and addresses the following questions: Why would ISPs offer zero-rating? Under which circumstances may zero-rating be harmful to consumers, content providers (CPs) and/or society at large, e.g., by limiting variety or consumers' choice? What are the main takeaways for regulators who have to decide which practices to prohibit?

Six key insights emerge from this report:

1. ISP's and society's interests are not necessarily aligned, possibly leading to an ISP's adoption of a zero-rating regime that is not in society's best interests. Thus, there is a need to take a closer look at zero-rating offers on a case-by-case basis.
2. Regulatory interventions that rule out certain contractual forms are strong interventions in the market and have to be based on a sound theory of harm. In the context of zero-rating offers, it is often crucial to evaluate the extent to which users are able to activate and deactivate a (throttled) zero-rated tariff option. If activation/deactivation is easy and instantaneous, a sound economic theory of harm for consumers will in many cases be hard to establish.
3. Similarly, if access to zero-rated partner programmes is non-discriminatory and entails low barriers to entry, a sound theory of harm for content providers will usually not be given. By requiring all content belonging to the same content category to be treated equally with respect to throttling, independent of whether a content provider opted for zero-rating or not, the existing regulation creates a negative externality on those content providers that do not wish to be zero-rated for some reason.
4. The practice of throttling can mitigate congestion problems and, in addition, contribute to a reduction of illegal content. Throttling of certain categories rather than universal throttling should be seen in a favourable light, as it allows for experimentation in new services, while reducing traffic volumes at peak time in well-established categories.

5. Particular attention should be paid, however, to the impact of throttled zero-rating tariffs on the competition between mobile network operators (MNOs) and mobile virtual network operators (MVNOs). The latter may not be able to compete on equal footing with MNOs, because they benefit less from the traffic management aspects of zero-rating. This is an important point but, interestingly, this issue has been neglected in the debate so far.

6. More generally, competition among (infrastructure-based) ISPs tends to provide a safeguard against severe rent extraction and, thus, an abuse of throttling as an exploitative device. Therefore, regulators should carefully account for the competitive environment and the existing tariff portfolio and options before deciding to intervene. Paradoxically, in the USA, where market power of ISPs is arguably stronger than in the EU, there now exists a much weaker network access regulation, which allows for much more contractual freedom than in the EU. After all, the debate about net neutrality and regulatory safeguards for IAS originated in the USA due to consumers' concerns of monopoly power. Moreover, it originated with respect to fixed line networks only. For this reason, in the FCC's first "Open Internet Order" from 2010, mobile networks were explicitly exempt from most of the net neutrality regulation. Yet, it is specifically in the competitive mobile environment in Europe where strict neutrality rules are exercised in the context of zero-rating.

1. Introduction

For more than a decade the issue of net neutrality has provoked an intense academic and policy debate about the appropriate set of rules that should govern Internet access services (IASs). The adoption of net neutrality rules in 2015, both in the United States and in the European Union (Regulation EU 2015/2120) seemed to have marked a first milestone in the policy debate surrounding net neutrality. However, the debate is far from over.

In the US, the Federal Communications Commission (FCC) has overturned the existing net neutrality rules in December 2017, essentially allowing (again) contractual freedom between Internet Service Providers (ISPs) and Content Providers (CPs), as well as consumers. This means that ISPs in the US can engage in all kinds of traffic management practices, including commercial agreements between CPs and ISPs to prioritise traffic based on content, type or origin. Moreover, ISPs in the US can experiment freely with different pricing models, including letting CPs pay for consumers' data use.

In the EU, the adopted net neutrality regulation (EU 2015/2120) limits the contractual freedom between ISPs and CPs as well as between ISPs and consumers, but also allows for several exceptions from a strict version of net neutrality. While overt pay-for-priority offers to CPs, which are currently legal in the US, are clearly illegal in the EU, other contractual agreements and practices, in particular so-called zero-rating (where some services are exempt from a consumer's data cap; to be defined precisely below) are currently under scrutiny with regards to their legality by several National Regulatory Authorities (NRAs), for example, by the German Bundesnetzagentur (BNetzA).

Questions about the legality of zero-rating practices arise because the regulation adopts a strict version of net neutrality on the one hand, but then allows for several exceptions, on the other hand. More specifically, in Article 1 the regulation lays out that it generally seeks to "*safeguard equal and non-discriminatory treatment of traffic in the provision of Internet access services and related end-users' rights*" and in the first subparagraph of Article 3(3) a strict definition of net neutrality is adopted by noting that "*Providers of internet access services shall treat all traffic equally, when providing internet access services, without discrimination, restriction or interference, and irrespective of the sender and receiver, the content accessed or distributed, the applications or services used or provided, or the terminal equipment used.*" On the other hand, Article 3(2) allows for *"Agreements between providers of internet access services and end-users on commercial and technical conditions and the characteristics of internet access services such as price, data volumes or speed, [...]"* as long as it does not limit end-users rights, laid out in Article 3(1), i.e. "*to access and distribute information and content, use and provide applications and services, [...], irrespective of the end-users' or provider's location, or the location, origin or destination of the information, content, application or service, [...]*". Furthermore, the second and third subparagraphs of Article 3(3) detail some exceptions in the context of "*reasonable traffic management*". Furthermore, Article 3(5) allows exceptions for specialised services, i.e., "*services*

other than Internet access services, which are optimised for specific content, applications or services, or a combination thereof, [...]". Due to a lack of clear guiding principle, economic actors and, in particular, ISPs have to operate in an uncertain regulatory environment.

The EU regulation does not explicitly mention zero-rating and in this report, we do not intend to engage in a legal discussion and interpretation of Article 3 in EU 2015/2120 in the context of zero-rating. This has already been done elsewhere (see, e.g., Fetzer, 2017, and Kühling, 2017), with partly conflicting conclusions; this corroborates our view that there is some room for legal discretion. Another area open to legal debate is which role the "BEREC Guidelines on the Implementation by National Regulators of European Net Neutrality Rules" (BoR (16) 127) that were published by the Body of European Regulators for Electronic Communications (BEREC) play in the assessment of the legality of zero-rating offers, above and beyond the regulation itself. On the one hand, the Guidelines were explicitly commanded by Article 5(3) of the EU regulation. However, the Guidelines are not a legally binding norm per se, but they do go into much more detail than the regulation and, in particular, explicitly discuss zero-rating.

In light of the legal discretion in the evaluation of zero-rating offers and a need to consider those practices on a case-by-case basis (see also BoR (16) 127b), an economic assessment of different zero-rating practices appears to be of first-order importance: Why would ISPs offer zero-rating? Under which circumstances may zero-rating be harmful to consumers, CPs and/or society at large, e.g., by limiting variety or consumers' choice? What are the main takeaways for regulators who have to decide which practices to prohibit?

2. A first look at zero-rating

2.1. What is zero-rating?

Generally, zero-rating denotes a tariff (or tariff option) that allows end-users to access certain content without being charged for the corresponding data consumption. Zero-rating is usually exercised in mobile networks, where it is common to sell end-user tariffs that entail a certain data allowance. Zero-rated content would then not count against that allowance. However, zero-rating is also possible in pay-per-use tariffs, where end-users would pay extra for each marginal unit of data consumption (say per Megabyte). Here, zero-rated content would incur an incremental data cost of zero.

It is important to highlight that, generally, zero-rating means only that certain content does not impose data costs for *end-users*. This does not rule out that the data costs are borne by a third party, i.e., neither the ISP nor the end-user. In particular, it is possible that a CP pays the ISP for the end-user's data consumption that accrues when accessing that CP's content. This latter practice is called "sponsored data" and offered, for example, by AT&T in the US.[1]

2.2. Classification of zero-rating practices

As highlighted above, whether the zero-rated data consumption is paid for by the CPs or not, already marks an important distinction for zero-rating offers. More generally, any case-by-case analysis of a zero-rating offer should consider the following questions to determine the offer's characteristics:

1. Does becoming a partner require monetary or non-monetary payments (e.g. payments in data) from the content partner to the ISP?
2. Is zero-rating part of a vertically integrated offer by the ISP?
3. Is there non-discriminatory access to becoming a zero-rated content partner?
4. Which implied or explicit costs have to be borne by CPs to become a content partner?
5. Do contract offers to consumers without zero-rating exist that correspond to those with zero-rating?
6. Can zero-rating be easily switched on and off by consumers (e.g. on an hourly or daily basis)?
7. Does (and if so, under which circumstances) zero-rating lead to a different transmission quality of content by zero-rated partners?
8. Does (and if so, under which circumstances) zero-rating lead to a different transmission quality of content by non-partners?

[1] See https://developer.att.com/sponsored-data

9. With respect to different transmission quality, are different types of content treated differently under zero-rating?

If the answer to questions 1 is "yes", then the zero-rating offer under consideration will most likely be seen in violation with EU net neutrality regulation. For example, a "sponsored data" regime, where zero-rated content partners need to make monetary payments, immediately raises concerns that are similar to those raised in the net neutrality debate response to pay-for-priority regimes – that is, there are concerns that fair and equal competition between CPs is endangered because only financially strong and "big" CPs would be able relieve their customers of the data costs associated with using their service, ultimately leading to a competitive advantage.

Questions 2 to 4 provide a classification about implicit or explicit discrimination to become a zero-rated partner. Questions 5 and 6 classify offers with regard to options available to consumers. Questions 7 to 9 classify the offer with regard to throttling – the practice of throttling can be seen as an ISP's enforcement of a speed limit for some or all types of service.

The zero-rating offer may well be in compliance with the net neutrality regulation laid out in Article 3 of EU regulation 2015/2120, but be ruled out on the grounds that it violates legal norms other than net neutrality (e.g. regarding the roaming regulation EU 531/2012 as amended by Article 7 of EU Regulation 2015/2120). We touch upon this possibility in Section 4.

From a European vantage point, with the current net neutrality regulation in place, the questions that will need careful consideration are questions 2 to 9; our exposition in Section 4 relates to them. In most of this report, we concentrate on the evaluation– from a European regulatory perspective – of the most relevant cases of "true" zero-rating plans, where the ISP offers to zero-rate content without monetary compensation by the CPs. Such zero-rating plans have been or are being pursued by, for instance, T-Mobile USA (BingeOn), Deutsche Telekom (StreamOn) and Vodafone (Vodafone Pass).[2] Nevertheless, we briefly comment on and summarise the economic literature on "sponsored data" (such as AT&T's Sponsored Data), which is still a relevant issue at least in the US (see Section 3.1).

2.3. Importance of prevailing market environment

ISPs enable consumers to access a wide variety of content; e.g. the possibility to interact with other users on social networks, to consume online news and entertainment, and to make purchases of physical products. Different types of consumers' activities require different transmission quantity characteristics, such as speed, jitter or latency; these requirements stem from decisions made by content providers (CPs) in the light of the existing internet infrastructure,

[2] Note that these tariffs may differ in other dimensions, such as whether the transmission quality of zero-rated content is throttled or not.

compression technology and industry standards. For example, video streaming of live news events has different requirements in these dimensions than written summaries of such an event.

Actors on the content side can serve niche audiences or have a large following. They may be profitable enterprises or be non-profit endeavours. There are many actors that operate as platforms in the sense that they manage network effects among their users.[3] They run different revenue models: for instance, they may charge consumers for usage (with a subscription or pay-per-use fee) or make bundled offers of content in combination with advertising.

Consumers are heterogeneous in their intended consumption pattern implying that they have different wants and needs regarding data volume, download speed and latency. For example, given their typically low income, high-school students may not mind reduced transmission quality if it comes hand-in-hand with higher effective data volumes and/or a lower price. Some other consumers may not have high demands of data-intensive content, but may want to be at the premium end in terms of transmission speed.

The distributions of consumer and content provider characteristics are important for the success of an ISP's zero-rating programme. They determine the surplus that accrues to an ISP introducing a zero-rated offer as well as the surpluses of the other actors in the market. Also, the competitive landscape for internet access matters. How many competing ISPs operate in the market? What are their technologies (e.g. the spectrum licenses they control) and business models?

As mentioned in the introduction, in this report we focus on the market for mobile internet access. In this market, mobile network operators (MNOs) are active often together with mobile virtual network operators (MVNOs), which come in different types. The success and economic impact of a zero-rating offer then depends on the competitive landscape in this market. It also depends on the substitution possibilities available to consumers across different technologies. In particular, ISPs have to understand when consumers have access to Wi-Fi networks to which their device can switch automatically or with little effort. In this market, ISPs have to make predictions as to how the various actors will respond to the introduction of a zero-rated offer. This leads to complex market interactions. Regulatory authorities better get it right to foresee the effect of their regulatory intervention; we address this issue in Section 4. Before doing so, we lay out business practices behind zero rating and their economic implications in a more stylised way.

[3] See, e.g. Belleflamme and Peitz (2018) for details.

3. Business rationales for zero-rating and economic implications

We provide four reasons why ISPs may be inclined to offer zero-rating tariffs at all. The default data plan entails a limited data allowance and that any content that is accessed by the end-user is served with the same transmission quality and equally counts against this allowance.

3.1. Revenues from CPs

ISPs can be considered to be two-sided platforms. That is, ISPs enable interaction between CPs, on one side of the market, and consumers, on the other side of the market, by setting prices to consumers and CPs for access to each other. Between these two groups, cross-group network externalities exist: consumers value the presence of many CPs, and vice versa.[4] A robust economic result in these types of markets, no matter what is the type of competition between ISPs, is that an exogenous price increase for one group (say the CPs) will lead to a reduction in prices for the other group (say consumers). This result is relevant in a regulatory context in which one price may be determined by regulatory intervention.

Net neutrality regulation can be understood as a zero-price regulation for CPs, meaning that non-discriminatory access to all CPs is offered by an ISP with a price equal to zero.[5] Thus, net neutrality regulation prevents the possibility of endogenous two-sided pricing where the fees that an ISP charges to consumers are counterbalanced by fees charged to CPs. This has two implications. First, net neutrality prevents ISPs to tap into the additional revenue stream coming from the CPs. Second, everything else being equal, end-user prices for internet access are likely to be higher with net neutrality regulation. In summary, if not constrained by regulation, ISPs would likely prefer to generate some additional revenues from the CP side of the market by offering CPs some benefit in return (e.g. prioritisation of data or exemptions from the users' data allowance).

The economics of sponsored data plans can draw on insights derived in the context of net neutrality more generally (see, e.g. Greenstein, Peitz, and Valletti (2016) and Easley, Guo, and Krämer (2017) for recent reviews of the net neutrality literature). Specifically, it is worth highlighting that the economic literature on net neutrality does *not* offer support for a strict net neutrality regulation, because net neutrality may i) prevent an efficient rebalancing of prices in a two-sided platform environment, ii) undermine an efficient use of scarce network capacity and iii) reduce ISPs' investment incentives in broadband infrastructure (cp. Easley, Guo, & Krämer, 2017).

[4] For a recent guide to the economics of platforms, see Belleflamme and Peitz (2018).
[5] See, e.g. Krämer, Wiewiorra, and Weinhardt (2013) and Greenstein, Peitz, and Valletti (2016).

To the best of our knowledge, there currently exist four working papers that explicitly consider the economic effect of sponsored data plans in the context of a two-sided market model: Jullien and Sand-Zantman (2016), Somogyi (2017), Jeitschko, Kim and Yakelevich (2017), and Qiu, Wang, and Jia (2017). All four papers identify circumstances under which the ISP would make larger profits under a sponsored data regime and, thus, has an incentive to implement it if allowed. More importantly, all four papers show that the welfare effects of such sponsored data are ambiguous; depending on parameters, sponsored data increase or decrease total welfare.

3.2. Increased revenues from consumers (price differentiation and tailoring)

An aspect that is, to date, less studied in the economics literature is that zero-rating may be used by the ISP to better cater to consumer tastes and to allow for more effective price discrimination. Inceoglu and Liu (2017) show in a recent working paper that ISPs can increase revenues also with "true" zero-rating tariffs (i.e. absent the possibility for sponsored data). Specifically, the authors show that a monopoly ISP can make larger profits by offering consumers a choice between i) a standard plan with data allowance and ii) a plan with data allowance, where some, but not all content is zero-rated, than if it were to sell two standard plans with different data allowances. The reason is that zero-rating improves the screening between consumers who differ in their valuation for different types of content. Here, zero-rating is used for price discrimination in a similar fashion as offering high- and low-quality versions of a product.[6]

Generally, the possibility to use zero-rating for price discrimination supports some concerns that have been raised regarding a rebalancing of the offered tariff portfolio. In the short-run, if zero-rating is just offered as an additional option at no extra costs for end-users, then these concerns are not justified. However, in the long-run, implied prices may rise for consumers (relative to a situation without the availability of a zero-rating option), for example, because data allowances remain relatively low. This may be coupled with efforts to engage in upselling of tariffs. However, consumers may fare better in a market with competing ISPs (see Section 3.4).

The introduction of different zero-rating options makes it possible for the ISPs to further differentiate and expand their pre-existing tariff portfolio. Thus, customers can select additional options (against some added payment) for self-customisation of data plans, or can switch between different data plans. In particular, the ISP may seek to incentivise customers to switch from less expensive (non-zero-rated) plans into more expensive (zero-rated) plans. This business practice is known as upselling. This motivation to introduce zero-rating has explicitly been stated by Deutsche Telekom in reference to StreamOn.[7]

[6] For a textbook treatment of price discrimination, see Belleflamme and Peitz (2015).

[7] See Section 2.1.3.2.3, paragraph 2 on p.25 of the decision of Bundesnetzagentur regarding Deutsche Telekom's StreamOn plan. Available at

Alternatively, zero-rating may be included in the ISP's existing tariff portfolio by default but at the same time, this is communicated as justification to increase the (implied) prices of existing plans (or not to lower the price against the industry trend). This seems to be the business strategy that is pursued by Vodafone in Germany in reference to the introduction of its zero-rating plan called Vodafone Pass.[8] Passes (i.e. zero-rating options for a set of content partners belonging to a specific content category) currently exist for the content categories "video", "music", "chat" and "social". Vodafone's default mobile tariffs include the first Pass for free, but the prices of the default tariffs have been raised. In addition, Vodafone also pursues an upselling strategy, as every additional Pass leads to an additional monthly charge to the consumer.

Evidently, the creation of more tariff options and "upselling" is closely related to the price discrimination argument. In any case, it is worth highlighting again that the extent to which prices can be raised and to which more surplus can be extracted from consumers is limited by the competitive pressure faced in the respective market (cf. also Section 3.4). In addition, consumer surplus is determined as the difference between gross surplus and price. Zero-rating provides an extra benefit for rational consumers who opt for this offer, everything else equal. If the default option becomes pricier, some of the consumers who opt into zero-rating may still be better off than without zero-rating available.

3.3. Traffic management

ISPs may employ zero-rating as a traffic management measure; this is likely to be the case in combination with reduction of transmission quality for some zero-rated content (and possibly other content), at the same time. As a result, the existing network capacity may be used more efficiently by the ISP. The reduction is transmission quality, called throttling, may apply to all traffic, only to zero-rated traffic, or only to certain categories of traffic (where we may also distinguish between throttling applied to all traffic from these categories or only zero-rated traffic from these categories). Except for the first version when all traffic is throttled, such practices connect to the net neutrality debate in the sense that possibly discriminatory treatment of traffic is an issue.

For ISPs, opportunity costs accrue predominantly due to congestion during peak times. Therefore, an ISP usually wants to install a network capacity that is just big enough in order to support sufficient networking ability during peak times. Thus, the costs of a network are mostly determined by the amount of peak traffic, and not, for example, by the total amount of traffic (say in 24 hours). Currently, during peak times, the majority of traffic is due to real-time entertainment services; i.e. mostly music and video-streaming services. For example, Sandvine (2015) estimates that in 2015 more than one third (35.89%) of the traffic volume during peak time in mobile net-

https://www.bundesnetzagentur.de/SharedDocs/Downloads/DE/Sachgebiete/Telekommunikation/Unternehmen_Institutionen/Breitband/Netzneutralitaet/Entscheidung_zu_StreamOn.pdf?__blob=publicationFile&v=2

[8] https://www.inside-handy.de/news/46585-vodafone-pass-bundesnetzagentur-ccc-und-vzbv-zu-netzneutralitaet

works in Europe was due to real-time entertainment services, making it the clear traffic category leader. In North America, the percentage is even higher (40.89 %, according to Sandvine, 2016) and in both regions, it is expected to grow further in the coming years.

Consequently, throttling the download speed of streaming services (which is the content category that is usually zero-rated) is likely to reduce peak traffic load. This increases delivery quality for content whose transmission quality is not reduced and, in the medium run, may alleviate the need to invest in additional network capacity, which saves on the ISP's investment costs. This motivation for zero-rating has not yet been formally explored in the economic literature, but it is supported by the communication of ISPs.[9]

From a total welfare perspective, zero-rating with throttling may well be a more efficient regime (i.e. lead to higher total welfare) than unthrottled zero-rating, or no zero-rating at all. Let us consider the welfare effects on consumers, CPs and the ISP in turn.

First, as a unilateral move by an ISP, zero-rating with throttling, whenever it is observed, should be beneficial for ISPs. In this context, we emphasise that it is in an ISP's own interest to carefully balance by how much it throttles the download speed of content, especially if it faces competition. If the download speed is throttled too much, then consumers are more likely to opt-out of the zero-rated plan and/or throttling, which undermines the intended reduction in peak traffic load; or even worse, consumers may switch to a competing provider. This suggests that the extent of throttling and resulting surplus effects are likely to depend on the intensity of competition among ISPs; i.e. how much market power the ISP enjoys. Concerns for a loss of reputation and interference with other marketing efforts and brand image (e.g. based on the reputation of having the "best network quality") may make an ISP averse to throttle to such an extent that there is a significant deterioration of user experience and, thus, will limit the extent of throttling. However, if too little throttling is done, the effect on peak traffic load is limited and in the extreme is even reversed. Whether ISPs with the option to introduce zero-rating with throttling benefit from such plans, is not obvious when they are competing with each other. It is well conceivable, that introducing such offers leads to more intense competition, eventually hurting ISP profits. Zero-rated plans with throttling are likely to be attractive for users who like to spend a lot of time streaming music and, in particular, video, but suffer from a tight budget. Competing

[9] See Section 2.1.3.2.3, paragraph 2 on p.25 of the decision of Bundesnetzagentur regarding Deutsche Telekom's StreamOn plan. Available at https://www.bundesnetzagentur.de/SharedDocs/Downloads/DE/Sachgebiete/Telekommunikation/Unternehmen_Institutionen/Breitband/Netzneutralitaet/Entscheidung_zu_StreamOn.pdf?__blob=publicationFile&v=2. However, in the broader debate on net neutrality, it has been pointed out that traffic management can alleviate congestion problems; see, e.g., Peitz and Schuett (2016) for a theoretical analysis of various traffic management measures.

ISPs drive the price down for such offers. *A priori*, it is not clear whether these differentiated offers play out in favour of ISPs.[10]

Second, with respect to consumer welfare, assume consumers pay the same for a zero-rated plan with throttling as for an (unthrottled) plan without zero-rating. Then, consumers' evaluation of the plan will crucially depend on whether the additional benefit from zero-rating (saving data costs, or, alternatively freeing up data allowance for non-zero-rated services) outweighs the costs of having to consume content with a lower transmission quality. This is an empirical question which answer depends on the effect of throttling on consumer experience. There are reasons to believe that many users may actually prefer zero-rating with throttling over no zero-rating. For example, in the US, T-Mobile reported that only 0.8% of its customers opted out of its zero-rating plan BingeOn.[11] If the reduction in transmission quality is such that consumers are still overall satisfied with the user experience (e.g. when watching video on their mobile device), then it is even conceivable that consumers may prefer a zero-rated plan with throttling over the same zero-rated plan without throttling. This may be the case because the former plan is less data hungry and allows consumers to access more content with the same data allowance (provided that not only zero-rated content in some categories but also other content from the same categories is throttled).

Third, for the same reasons, it is not obvious that CPs may prefer an unthrottled non-zero-rated plan over a throttled zero-rated plan. If the latter plan allows CPs to attain consumers' attention more often, this is likely to drive up the CPs' revenues (e.g. from advertising). Indeed, under the BingeOn plan, T-Mobile USA throttled all "detectable" video per default, but allowed CPs to opt out of such throttling. Interestingly, as of February 2018, no CP has opted out.[12]

Despite the likely positive effects on consumers and ISPs, we do not claim that throttling is necessarily a welfare-increasing practice. But it would also be wrong to condemn it as unambiguously welfare-decreasing. Private and social interests in the degree of throttling are unlikely to be perfectly aligned. However, prohibiting throttling may well lead to lower total and consumer surplus than profit-maximising throttling. It is important to understand that a welfare-maximising planner would also use throttling as a traffic management instrument, if it is not allowed to prioritise certain types of traffic with price or non-price instruments. In this sense, zero-rating with throttling can be seen as a remedy to limited capacity in a world with net neutrality rules in place that make it impossible to engage in other, possibly more efficient mechanisms to allocate scarce capacity. As long as a zero-rated plan with throttling is offered along a plan with similar price and data allowance, consumers who do not mind the loss in quality very

[10] On a more abstract level, the question is whether uniform offers or a menu of offers lead to higher profits among competing ISPs. For formal models of menu pricing with competition, we refer to Armstrong and Vickers (2001, 2010) and Ellison (2005). See also Belleflamme and Peitz (2015).

[11] See https://www.fiercewireless.com/wireless/t-mobile-s-ray-less-than-1-customers-turn-off-binge-video-service

[12] See https://www.t-mobile.com/offer/binge-on-streaming-video.html

much relative to the benefits this plan offers are the ones picking it up. A zero-rated plan with throttling can be considered to be a horizontally differentiated offer. Unless there is a severe price increase, this increase in the variety of data-consumption packages increases total welfare.

In a market with competing ISPs, the ISP's decision about the degree of throttling is driven by the additional profit at the margin, while total surplus is driven by the effect of throttling on average. It is an open (empirical) question to what extent the ISP would internalise the welfare effect of throttling. However, for the above-mentioned reasons, competition among ISPs is likely to limit the ability of an ISP to increase its price in response to offering an additional, zero-rated plan with throttling. Thus, we would expect the introduction of zero-rated plans with throttling to be typically welfare-increasing when there is competition among ISPs.

We would like to make two qualifications to our claim. First, we do not have a good understanding of the effect of zero-rated plans with throttling on the viability of service-based providers (MVNOs). If many of them were to disappear, prices would likely move upward.

It is also difficult to predict the effect to throttling on the innovation incentives of content providers. Regarding this second qualification, throttling of particular categories of data may be preferable to across-the-board throttling. For instance, if only video content is throttled (and there is a good understanding on its effect on viewers' experience) other up-and-coming content (e.g., related to health and mobility) for which data requirements are yet unclear are not affected and, thus, do not put a break on innovation.

In any case, there is little economic logic in applying the same degree of throttling to all categories of data, since their thirst for bandwidth and, more importantly, the quality deterioration as the result of throttling is application-specific. Therefore, one should entertain the idea that there is throttling for various categories of data, albeit the degree of throttling is category-dependent.[13] A principle to treat all things (including unequal ones) equal leads to a misallocation of scarce resources.

3.4. Market positioning of ISPs

In a competitive market, zero-rating allows the ISPs to offer a more differentiated access product. This may have two implications.

First, zero-rating offers ISPs to compete in more dimensions, other than just price and data allowance, regarding their data plans. In particular, ISPs may compete regard to (i) degree of throttling of zero-rated content, (ii) the number of different content categories that can potentially be zero rated, and (iii) the amount and identity of content and content providers that is

[13] A downside is that it becomes more difficult for consumers to compare zero-rating offers by competing ISPs with each other.

zero-rated in each content category. *A priori*, it is not clear whether this will intensify or relax competition between ISPs.

On the one hand, the possibility to better differentiate tariff plans, allows ISPs to make less comparable offers, through which competition may be relaxed (cf. Johnson & Myatt, 2003). In particular, ISPs may choose to relax competition through (*de facto*) exclusive zero-rated content.[14] Consequently, in case it is observed that CPs choose to be zero-rated only with one of the CPs that offer otherwise comparable zero-rating programmes, then this should raise concerns that zero-rating is used as a facilitating device and that there may be side-payments between ISPs and CPs to incentivise CPs to do so. In any case, under these conditions, a closer investigation by the regulator or competition authority is warranted.

On the other hand, it is also possible that zero-rating increases competition, at least with respect to other ISPs that can also offer zero-rating. In particular, competition between zero-rating ISPs in the above dimension may lead to (even) lower barriers of entry for content partners, such that more and more content becomes zero-rated. For example, in the USA, zero-rating was just a step on the ladder towards (unlimited) flat rate tariffs: instead of BingeOn, T-Mobile USA now markets a plan called “T-Mobile ONE”, which includes unlimited data (i.e. zero-rates all content), but still throttles video content.

Second, zero-rating with throttling may allow infrastructure-based ISPs (i.e. mobile operators having their own network) to differentiate their internet access product from service-based ISPs (e.g. MVNOs) and, thereby, to relax competition and to gain market shares from those ISPs that do not offer zero-rating. An overview of existing zero-rating plans in Europe in a report commissioned by the European Commission[15] revealed that zero-rating offers are almost exclusively offered by network operators, but not MVNOs. The reason for this may well be that MVNOs buy data volumes from network operators on a wholesale basis.[16] Consequently, unlike infrastructure-based ISPs, MVNOs care about the increase in total traffic volume that is associated with zero rating, and do not benefit from the reduction in peak traffic load. In other words, MVNOs do not benefit from the traffic-management argument laid out in Section 2.3 to the same extent as infrastructure owners. This can explain why MVNOs perceive the introduction of competitive zero-rating plans as too risky, because the expected increase in traffic volume is not counterbalanced by a reduction in network investment costs or an increased ability to accommodate additional demand at peak times.

[14] For an analysis of exclusive content in the net neutrality debate, see Kourandi, Krämer, and Valletti (2015).

[15] See http://ec.europa.eu/competition/publications/reports/kd0217687enn.pdf

[16] This holds regardless of whether the contract between infrastructure-based ISP and MVNO features a per-unit charge or a long-term pre-commitment to a specified data volume, as long as the payment neither explicitly nor implicitly depends on the shadow price of the use of network capacity; i.e., as long as the price paid by the MVNO does not depend on whether the use happens in a peak or off-peak period of the relevant part of the network.

4. Whether and how to regulate zero-rating?

As discussed in Section 2, quite a number of business practices can be considered as zero-rating. The common feature is that zero-rated data plans have a data cap and that zero-rated content is treated differently by not counting towards this cap. In the following we discuss the most contentious regulatory issues that have been raised in the context of zero-rating from an economic perspective.

4.1. Partner selection and discrimination

An important decision by an ISP is whether it designs its partnership programme in such a way that it is of interest only for a limited few content providers or that it has wide appeal. In "selecting" its partner, the ISP can use price and non-price instruments. When a consumer opts for a zero-rated plan, content providers no longer compete on a level-playing field, as content providers not chosen as partners are typically less attractive to consumers.

This implies that non-discriminatory access to becoming a zero-rated content partner is crucial. This entails that becoming a partner must be voluntary and at equal terms for all content providers of a particular category. In addition, one may argue that it should not entail significant monetary payments (sponsored data) or non-monetary payments (e.g., obligations to share resources or data). Moreover, implementation costs for becoming a zero-rated partner should also be manageable for financially weak CPs. Zero-rating should not impose significantly increased liability or other legal risks onto the content partner, other than what would be present if the CP had not become a content partner. Everything else given, higher barriers to becoming a zero-rated partner raise competition concerns about a zero-rating programme. We would argue that these concerns are stronger if the ISP has significant market power. In principle, zero-rating programmes with monetary payments can be scrutinised by competition authorities as a potential abuse of a dominant position. Thus, we refrain from taking a position as to whether specific regulatory interventions may be needed in this case.

Furthermore, CPs and ISPs should have a duty to notify each other regarding technical changes that would impact the ability to zero-rate content.[17] At least some CPs (e.g., Vimeo) argue that increased technical implementation efforts as well as unclear legal consequences and liabilities, along with undue lead times, have prevented them from becoming a zero-rated content partner.[18]

In addition, we want to emphasise that non-price instruments in selecting partners for zero-rating can function as a quality control. More specifically, content providers offering illegal con-

[17] However, it is debatable how long an appropriate lead time for such a notification would be, and which (legal) consequences may arise from a late notification.

[18] See http://www.tagesspiegel.de/downloads/19872192/2/vimeo_stellungnahme_stream-on.pdf

tent (e.g., material that violates copyright) may be unable to attain partnership status. While it is debatable whether the ISP should be given the power to decide on whether or not content is legal, in most cases the legality control will occur implicitly, because operators of such illegal content sites will not be willing to come forward to sign a zero-rating agreement with the ISP, as this would reveal their identity. Thus, zero-rating may well be in the interest of content providers offering legal content, as it makes consumption of illegal content less attractive, because this illegal content counts towards the data cap. In this sense, zero-rating partner programmes can implicitly act as a legality control mechanism, which per se can be seen as welfare-enhancing, as it restores the functioning of property rights. However, it should also be mentioned that such a quality/legality control mechanism is necessarily imperfect and has an impact predominantly on content that requires large volumes of data (e.g., video or music streaming services). Consequently, providers offering legal content requiring large data volumes are the ones that have strong incentives to become a partner in zero-rating programmes and are more likely to accept the partnership criteria set by the ISP. In reverse, it can be argued that if these content providers are reluctant to becoming a partner, the criteria for becoming a partner may be too restrictive and need to be scrutinised by regulators.

On the extreme side of discriminatory access are vertically integrated zero-rated offers and the impossibility of third parties to be included. Arguably, this may stimulate the development of innovative offers by ISPs. If, for instance, a small ISP comes up with an attractive, vertically integrated offer it may be able to survive in the competition by offering a premium service. In a similar vein, one can view the existence of SMS flat rates or voice telephony flat rates that are bundles together with a data plan as akin to zero-rated vertically integrated services. However, it is important to keep in mind that any ISP with vertically integrated zero-rated offers partially forecloses part of the market, since CPs obtain access to consumers at less favourable terms. The economic analysis here is similar to the one in other market environments (e.g., the analysis of search neutrality in the context of search engines favouring vertically integrated offers). The key question is whether there is an efficiency defence for the use of vertically integrated zero-rated offers – an efficiency arises if, due to vertical integration, the consumer experience is improved. Absent efficiencies, offering vertically integrated offers foreclose CPs from providing innovative services and are likely to negatively affect consumers and society at large. Again, such allegedly anticompetitive behaviour can be scrutinised by competition authorities and, thus, does not prove the need for regulatory intervention.

4.2. Throttling

One of the most contentious issues associated with zero-rating is whether it may be coupled with throttling of download speeds of zero-rated content, or of some traffic categories which qualify for zero-rating. Recital 15 and Article 3(3) of EU Regulation 2015/2120 condemn all traffic management measures (such as throttling) to control network congestion that are permanent (in contrast to “exceptional and temporary” traffic management measures). At the same

time, Article 3(2) explicitly allows agreements between ISPs and end-users on the "technical conditions" of the IAS, such as "data volumes or speed".

As we will detail next, even without consideration of zero-rating, this is an inconsistency in the regulation that is hardly understandable from an economic point of view; it has also been criticised from a legal point of view (Fetzer, 2017). On the one hand, according to Article 3(2) it is legal to offer tariffs that permanently throttle download speed, and to offer data plans with an unthrottled data allowance, but which permanently throttle download speed (possibly to zero) once the data allowance is exceeded. On the other hand, it is illegal to permanently throttle certain categories of traffic (say video). The economic rationale for such a treatment is questionable. For example, say a user has the choice between 1) a plan with a maximum download speed of 2 MBit/s and an allowance of 1 Gbyte and 2) a plan with a maximum download speed of 20 Mbit/s and an allowance of 1 Gbyte, and 3) a plan with a maximum download speed of 20 Mbit/s and an allowance of 1 Gbyte, where some content category is throttled to 2 MBit/s. Technically, the third (illegal) plan is a convex combination of the first two (legal) plans. Moreover, as argued above (see Section 3.3), category-specific throttling can well be in the interest of consumers and even content providers. Thus, no tariff is per se dominated by another tariff from a consumer perspective and consumers will choose the tariff that suits them best; i.e., their freedom of choice is not limited by the additional option.

In reverse, one may question why a (commonly marketed and legally accepted) plan, according to which download speeds are throttled after some data cap has been reached, is seen in a benign light, because here the throttling depends on whether the cap has been reached or not (which lacks a "reasonable traffic management" justification). However, only allowing unlimited and non-throttled data plans is clearly not a viable path.

From an economic perspective, we conclude that, on its own, throttling is not problematic, at least as long as consumers have an economically viable choice between a menu of contracts with different throttling options.

The issue then is whether throttling is problematic in combination with zero-rating. Three aspects are worth discussing here.

First, is it problematic that all but zero-rated content is throttled (to a speed of zero) once the data cap has been reached? According to the BEREC Guidelines BoR 16(127), this is clearly illegal. However, from a consumer perspective, it is clearly better to still have access to some content after the download cap is reached than to not have access to any content anymore. Thus, from a welfare perspective, the question must be whether (non-discriminatory access to) zero-rating distorts competition among CPs – this is the concern we discussed in the previous subsection.

Second, is it problematic when zero-rated content is throttled, even before the data cap has been reached? As argued in Section 3.3, category-specific throttling is not problematic per se. There are good reasons for ISPs to throttle transmission of data from rather mature categories, where

it is proven that they are responsible for a substantial fraction of traffic and where it is well-understood to what extent the consumption experience is affected by throttling. Throttling can then be an effective measure against excessive volumes of traffic, as it reduces the volume in peak times and, thus, leads to an overall better consumption experience in times of scarcity. Whether throttling of zero-rated content must be maintained permanently (which is seen to be in violation of the EU regulation) or to what extent throttling can be made time-dependent (which could be in line with the EU regulation) is a technical question, which needs answering. Possibly, throttling only has to be introduced at peak times. In any case, the focus on specific well-established (zero-rated) content categories has the advantage that experimentation by content providers in other categories can continue and, therefore, from a regulatory perspective, should be seen as a virtue of the zero-rating offer.

Moreover, in light of the preceding discussion of potential competitive advantages by zero-rated content providers, it is important to highlight that the benefit of zero-rating comes at the cost of throttling. This implies that competition concerns matter less, as zero-rated content by partners is delivered in lower quality.

Third, is it problematic when non-zero-rated content belonging to the same content category as zero-rated content is throttled to the same extent as zero-rated content? Potentially problematic is the provision of zero-rating in this context. Equal and fair competition can mean that CPs who do *not* want to become a content partner do not suffer a negative externality from zero-rating. Then, access to those CPs should be exactly as it would have been without a zero-rating option. In particular, this means that it can be seen as problematic when all CPs belonging to a certain category (e.g., all “detectable video content” as in the case of BingeOn or StreamOn) are throttled with the introduction of a zero-rating option. This means that a CP‘s outside option is altered, and consequently it is questionable if a CPs was actually making a “voluntary” choice when becoming a content partner.

However, in light of the existing net neutrality rules in the EU, it is questionable whether an ISP is allowed to make contractual agreements with a CP to become a throttled zero-rated partner, without having the obligation to throttle similar content of non-partners as well (see Article 3(3)c of EU Regulation 2015/2120 as well as BEREC Guidelines BoR 16(127), numbers 62-67). In this regard, the obligation to handle all traffic (at least of the same category) equally may limit a CP’s freedom of choice in becoming a content partner. Especially for premium providers, the throttling of non-partners can be problematic and, thus, may be detrimental to innovation on the CP-side. The more narrowly defined the category, the less widespread is this problem. For this reason, if throttling of non-partners is allowed, a narrow category to which throttling applies is less likely to harm society than a wide category.

With throttling for certain categories (independent of being zero-rated or not) in place, it is a dominant strategy for all CPs in those categories to try to become a zero-rated partner, as long as becoming a partner is sufficiently easy. If, in practice, only a few CPs are listed as partners,

this tends to show that it is too costly or too difficult to become a partner. Regulatory authorities need to seriously investigate such complaints by CPs.

Thus, we conclude that, provided that consumers can easily switch between zero-rated and non-zero-rated offers, non-discriminatory throttling should *not* be a concern for regulators. However, it depends on the flexibility and ease by which a consumer can switch between plans to make sure that all consumers actually benefit. For instance, if a consumer can start the month without zero-rating and associated throttling and opt into zero-rating as soon as the cap becomes binding, all traffic would be treated the same as long as the data cap has been reached. Then, consumers who opt for throttling from the beginning have shown that they actually prefer this over the consumption bundle described before.

The crucial regulatory question, therefore, is to which extent consumers suffer from lock-in when choosing a data plan with zero-rating and throttling. Consumers must be able to choose from comparable tariffs without zero-rating and/or without throttling of specific content to truly have freedom of choice. Then, they are likely to benefit from the more-differentiated tariff portfolio that has been made possible because of zero-rating and throttling. In particular, this requires that in tariffs with (throttled) zero-rating, consumers should be given the option to switch zero-rating on or off at their discretion. For example, if consumers can switch zero-rating instantaneously on or off through an app on their device, then freedom of choice is not affected. If the choice is more limited (e.g., switching takes hours or days to take effect; switching decision is only activated for some limited time period and needs to be renewed; each switching decision implies costs), then the evaluation may be less optimistic and needs to be scrutinised on a case-by-case basis. In this context, it also matters whether consumers have to opt in or opt out of zero-rating. From a consumer transparency perspective, it is advisable that consumers have to opt into more complex plans and use simple non-zero-rated plans as default.

We note that external effects may inhibit CPs' investment decisions. Specifically, when opting for a throttled zero-rated tariff, it is conceivable that individual choice is indirectly affected by the average choice other consumers make. As an extreme and stylised example, suppose that all consumers but one opted into throttled zero-rating. As a response, CPs may not invest further into new bandwidth-demanding services (e.g., the introduction of 4K video streaming), as the niche of customers that can use these services is too small. Thus, there will be no benefit for the consumer who abstains from zero-rating in order to avoid throttling. This is an example of the chicken-and-egg problem that features prominently on two-sided platforms such as ISPs.[19] The argument can also be reversed. If only very few consumers choose a throttled zero-rating tariff, then CPs may not bother to adapt their content to those throttled users.

We expect these externalities not to be important in practice, since there are several qualifications that need to be made, which all limit the size and relevance of such cross-group externali-

[19] The seminal paper on the chicken-and-egg problem on platforms is Caillaud and Jullien (2003).

ties. First, the argument ignores that consumers can access the content via different networks, particularly mobile and fixed networks, and that throttling in fixed networks (or more generally bandwidth limitations in fixed networks) is less restrictive. Thus, the argument above applies more to those CPs that are predominantly accessed via mobile networks. Second, for most bandwidth-intensive applications (such as video or music streaming) it is technically relatively easy to dynamically and automatically lower the quality and bandwidth-demand of the service. In multimedia streaming, a common technique is "adaptive bitrate", which adapts the quality in real-time based on bandwidth and CPU capacity.[20] It is therefore unlikely that CPs will produce only low-quality content, say in 480p, only because a significant number of consumers are on a throttled zero-rated tariff, since it is more efficient to produce high quality content, say in 1080p, and to dynamically adapt the quality downwards. However, new investments in future quality demands (say 4K) may be delayed. Third, with multiple active ISPs, underinvestment by CPs appears to be less likely, as ISPs have incentives to offer differentiated contract menus and manage to solve the chicken-and-egg problem between CPs and consumers, as this provides a competitive advantage.

4.3. Security and privacy issues

Little is known about the actual technical details through which zero-rating is implemented. Some concerns have been raised that in practice zero-rating may only be possible for non-SSL traffic (van Schewick, 2016) and that the use of deep packet inspection (DPI) is required.[21] Given the limited information on the actual implementation and technical requirements to deploy zero-rating, little can be said here about whether these technical restrictions and means are justified and indeed necessary. The crucial question remains whether becoming a zero-rated content partner is non-discriminatory and whether entry barriers are sufficiently low. In this context, this means that the CPs shall not be required to use a specific standard or technical infrastructure at the choosing of the ISP if this significantly raises entry barriers. It seems acceptable that a (set of) common or de-facto industry standard(s) can be required (e.g., Adaptive Bitrate in the context of internet streaming) to prevent a hold-up problem by a minority of CPs (deliberately) deploying outdated or exotic standards.

However, we believe that such technical difficulties should not become a reason for obstruction against zero-rating per se, as technical difficulties can be overcome. For example, a common standard for labelling zero-rated content could be developed that both ISPs and CPs can adopt. This would not only reduce the entry barriers to becoming a zero-rated content partner at any

[20] See https://en.wikipedia.org/wiki/Adaptive_bitrate_streaming.

[21] See Section 2.1.3.2.4, pp.27 of the decision of Bundesnetzagentur regarding Deutsche Telekom's StreamOn plan. Available at https://www.bundesnetzagentur.de/SharedDocs/Downloads/DE/Sachgebiete/Telekommunikation/Unternehmen_Institutionen/Breitband/Netzneutralitaet/Entscheidung_zu_StreamOn.pdf?__blob=publicationFile&v=2

given ISP, but also make ISP-specific adaptations in the implementation obsolete, and it would possibly reduce the necessary lead times for change notifications significantly.

Moreover, this could also significantly reduce the need to use DPI for detection of zero-rated content. Generally, the use of DPI must be limited to the extent necessary to differentiate different traffic classes for the sole purpose of zero-rating, and no other use of that information should be pursued. Anyhow, it is worth highlighting that, unlike in the US, ISPs in the EU need to adopt the high data protection standards prescribed by the ePrivacy Directive and the General Data Protection Regulation, as well as the security standards prescribed in the Directive on Security of Network and Information Systems (NIS Directive).

4.4. Zero-rating and roaming

Another contentious issue that has been raised in connection with Deutsche Telekom's zero-rating offer StreamOn is that zero-rating would be automatically deactivated when the user makes use of roaming in other EU Member States, thereby violating the roam-like-at-home (RLAH) principle laid out in Article 7 of EU Regulation 2015/2120. Article 7 is the result of the EU's digital single market strategy and pursues a political and not necessarily economic goal. Here, we focus on economic rationales of zero-rating and, therefore, we do not comment on whether the RLAH principle is justified or not. Nevertheless, we wish to point to two issues in the context of the application of the RLAH principle and zero-rated offers.

First, from an economic perspective, it is hard to see a rationale for why it should be legal to offer 1) a tariff without RLAH at all and 2) a tariff with RLAH for all content, but illegal to offer 3) a tariff that includes RLAH, but not for some (zero-rated) content categories. Similar to the argument made in the context of throttling, the (illegal) tariff 3 is just a combination of the (legal) tariffs 1 and 2. Moreover, also similar to the arguments made in the context of throttling, the exclusion of zero-rated content from the RLAH principle should, if anything, alleviate competition concerns.

Second, it has been argued with reference to T-Mobile's zero-rating tariff in the Netherlands that it would suffice to comply with the RLAH principle if an additional roaming data allowance would be introduced for the zero-rated content.[22] Suppose that the user has a tariff with a data allowance of 2 Gbyte, where all video content is zero-rated. Then, it would be sufficient and legal to introduce an additional roaming data allowance exclusively for video content, say 1 Gbyte, that is used only when the user makes use of roaming. This is possible, because the RLAH principle is subject to a fair-use-clause. Then, it is evident that there possibly exists a continuum

[22] See, e.g., See Part II, Section 2.1.1.2.3, pp.46 of the decision of Bundesnetzagentur regarding Deutsche Telekom's StreamOn plan. Available at https://www.bundesnetzagentur.de/SharedDocs/Downloads/DE/Sachgebiete/Telekommunikation/Unternehmen_Institutionen/Breitband/Netzneutralitaet/Entscheidung_zu_StreamOn.pdf?__blob=publicationFile&v=2

of data tariffs, ranging from tariffs with no extra roaming data allowance for zero-rated content to tariffs with infinite extra roaming data allowance for zero-rated content. How much extra roaming data allowance is sufficient for a given zero-rating tariff? Where should a regulator draw the line here? The fair-use-clause and its application to standard tariffs with data caps or flat rates has been specified in the Commission Implementing Regulation (EU) 2017/2286. However, it is not clear how this regulation applies to zero-rated tariffs, which entail a flat rate only for some content categories, especially if zero-rating should be coupled with throttling. In the simplest case of an unthrottled zero-rated tariff, one can even argue that there should be no additional roaming data volume as long as zero-rating is offered as a free option.

To see this, consider the following example. Suppose that there exists a data tariff without throttling in which zero-rating can be activated or de-activated at any time. The zero-rating option is offered for free, i.e., there exists an otherwise comparable tariff for the same price in which zero-rating is not possible. Article 4(2) of the Regulation determines the minimum required roaming volume of this tariff as follows:

$$Roaming\ Data\ Volume\ (in\ MByte) = 2 \cdot \frac{Total\ Domestic\ Retail\ Price\ (excl. VAT)}{Regulated\ Maxium\ Wholesale\ Roaming\ Price\ per\ MByte}$$

So how should the roaming data volume change if zero-rating is activated/de-activated. Since the zero-rating option is free of charge, this means that the domestic retail price in the formula above is the same, and, thus, the roaming volume specific to zero-rated content is zero. This means that the overall roaming data volume should remain unchanged. Thus, all consumption of content that is zero-rated in a particular country should fully count against the roaming data volume when accessing content from abroad.

In case of a throttled zero-rated tariff, it is not clear to us how this formula can be applied at all.

5. Conclusions

Zero-rating offers are novel contractual terms that affect both content providers and consumers. They are not necessarily benign nor do they necessarily harm society. They do have some connections to the net neutrality debate, but it appears to be important to get the economics for these types of contracts right instead of relying on vague analogies with other attempts to charge and discriminate against CPs for the delivery of traffic.

Regulatory intervention should be based on the specificities of the case and an appropriate theory of harm. This theory of harm may take a particular interest in consumer welfare, while taking into account that effects on content providers are likely to have an impact on consumers as well. The theory of harm may identify particular competition concerns or point out inefficiencies; it may also be based on a reasonable theory of consumer biases or consumers' limited information.

We provided a number of arguments that put into doubt whether a strict interpretation of the EU's existing net neutrality rules in the context of the emerging zero-rated tariffs is actually in the consumers' and society's best interest. In our conclusion we make six points:

1. ISP's and society's interests are not necessarily aligned, possibly leading to an ISP's adoption of a zero-rating regime that is not in society's best interests. Thus, there is a need to provide an economic assessment of zero-rating offers on a case-by-case basis.
2. Regulatory interventions that rule out certain contractual forms are strong interventions in the market and have to be based on a sound theory of harm. We have highlighted that in the context of zero-rating offers, it is often crucial to evaluate the extent to which users are able activate and deactivate a (throttled) zero-rated tariff option. If activation/deactivation is easy and instantaneous, a sound economic theory of harm for consumers will in many cases be hard to establish.
3. Similarly, if access to zero-rated partner programmes is non-discriminatory and entails low barriers to entry, a sound theory of harm for content providers will usually not be given. By requiring all content belonging to the same content category to be treated equally with respect to throttling, independent of whether a content provider opted for zero-rating or not, the existing regulation creates a negative externality on those content providers that do not wish to be zero-rated for some reason.
4. The practice of throttling can mitigate congestion problems and, in addition, contribute to a reduction of illegal content. Throttling of certain categories rather than universal throttling should be seen in a favourable light, as it allows for experimentation in new services, while reducing traffic volumes at peak time in well-established categories.
5. Particular attention should be paid, however, to the impact of throttled zero-rating tariffs on the competition between mobile network operators (MNOs) and MVNOs. The lat-

ter may not be able to compete on equal footing with MNOs, because they benefit less from the traffic management aspects of zero-rating. This is an important point but, interestingly, this issue has been neglected in the debate so far.

6. More generally, competition among (infrastructure-based) ISPs tends to provide a safeguard against severe rent extraction and, thus, an abuse of throttling as an exploitative device. Therefore, regulators should carefully account for the competitive environment and the existing tariff portfolio and options before deciding to intervene. Paradoxically, in the USA, where market power of ISPs is arguably stronger than in the EU, there now exists a much weaker network access regulation, which allows for much more contractual freedom than in the EU. After all, the debate about net neutrality and regulatory safeguards for IAS originated in the USA due to consumers' concerns of monopoly power. Moreover, it originated with respect to fixed line networks only. For this reason, in the FCC's first "Open Internet Order" from 2010, mobile networks were explicitly exempt from most of the net neutrality regulation. Yet, it is specifically in the competitive mobile environment in Europe where strict neutrality rules are exercised in the context of zero-rating.

From a more fundamental perspective, with the emergence of zero-rating offers, in particular, in combination with throttling, the strict application of the existing EU net neutrality regulation may be worth discussing and re-assessing in the future.

First, the EU regulation goes against any permanent (also in the sense of predictability recurring) traffic management practices and prefers that ISPs install more network capacity instead (see Recital 15 and Article 3(3)c of EU regulation 2015/2120). This is questionable from an economic perspective, because it denies ISPs (and society) the right to make efficient use of installed capacity. As we have argued, load shifting and peak clipping of network traffic are legitimate traffic management objectives that may also be in the interest of consumers and content providers. Otherwise, installing more network capacity just to handle peak load traffic leads to significant social costs, e.g., because more cell towers need to be installed in somebody's neighbourhood (often appealed by citizen's initiatives), higher energy consumption and more electromagnetic interference. Interestingly, in other domains, such as energy networks or roads, the reasoning often appears to be exactly the opposite. There, instead of installing more capacity (or to limit this increase), a more efficient use of the existing capacity is called for politically – e.g., there is strong political support for smart meter rollout as a means to better align energy demand to supply by lowering peak demands. Consequently, in particular in competitive market environments, an efficiency defence for the use of permanent traffic management practices that cater to a certain category of content should be allowed.

Second, according to the existing EU regulation, IAS that allow access only to certain (categories of) content and block or throttle all other content are per se illegal (see, e.g., Recital 4 and Article 2(2) of the EU regulation and the BEREC Guidelines BoR (16) 127, no. 13-18). Again, provided a competitive market environment and the existence of a portfolio of tariff options, it is puzzling

why tariffs should be ruled out that allow consumers to access only parts of the internet (so called sub-internet services) or that permanently throttle or block certain content or content types. As long as customers truly have a choice – i.e., a comparable plan where all content is unthrottled or not blocked must be available – we conclude that consumers should be allowed to voluntarily opt for throttling of certain traffic categories, say video streaming service, in order to economise on their data allowance, even without consideration of zero-rating. If such throttling were implemented in the end-users' devices (which, e.g., is a readily available option in the software of some routers), then this would not be considered illegal, because it would fall outside the scope of the regulation. Likewise, if some mobile operating system denied access to specific content, then this would not be considered a violation of the net neutrality regulation, even if such blocking occurred without the user's consent. Given the current prevalence of only two mobile operating systems (Android and iOS) versus the existence of usually at least three mobile network operators (not counting MVNOs) in EU member states, it is astonishing that there exists strict ex-ante regulation in this regard for the latter group, but not the former. From an economic perspective, one can question why consumers should not be in the position to agree to a tariff plan that allows them only to access some, but not all, available content – provided that users indeed have an economically viable choice to select an alternative tariff without such limitation. A sub-internet service may, for example, be attractive to parents who want to grant their children access to messenger services to stay in contact with them, but do not want them to access to all content available online. Similarly, low-income households may prefer a sub-internet access service at a much-reduced price over a fully-fledged internet access that they cannot afford or prefer not to choose.

In summary, it is evident that most of the concerns that are raised in the context of zero-rating boil down to competition policy concerns that require a case-by-case analysis taking into account the competitive environment of the respective market. In reverse, strict ex-ante regulation and prohibitions can in many cases be detrimental to consumer and total welfare. At this point, we do not argue for the abolishment of net neutrality rules per se, as arguably ISPs are in a strong economic position after a contract has been concluded with a customer (so-called termination monopoly). However, in cases where there is no clear theory of harm for consumers or content providers, market dynamics and tariff innovation should be able to unfold freely and emerging issues may well be addressed by competition law ex-post.

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