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Economic contribution to the debate on cost sharing policy

Edmond Baranes* Cuong Hung Vuong†

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Abstract

This policy paper aims to contribute to understanding the recent debate on fair cost sharing between Big Techs and European telecommunication operators who offer complementary services: content and access to the Internet. We take stock from recent economic literature and empirical evidences to show the differences in business models and regulatory constraints have led to unequal net benefits from growing European digital economy. Because the telecommunication operators have to bear the full costs of delivering content to end-users, their business is strongly affected due to the sharp increase in traffic generation. This negative externality should be internalized to correct the related market failure and to restore incentives to invest in the network infrastructure to meet the ambitious Europe's Digital Objectives. Furthermore, we assess the interplay between access and content, and demonstrate how a fair cost sharing policy can impact investment, consumer surplus and social welfare. In particular, content providers that are efficient in monetizing consumers are incentivized to lower the cost of content to consumers, which positively impacts the consumer surplus and social welfare. Also, because cost sharing can even encourage digital platforms to better optimize traffic generation, this could have potentially positive effect on the environment. Finally, we give some recommendations to effectively implement the policy in practice.

JEL Codes: D62, L11, L86

Key words: digital platforms, externality, cost sharing

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1 Introduction

The European telecommunications sector has been transformed from state monopolies to competitive markets of both fixed and mobile telephony. One of the main instruments for this transformation is regulation adopted at both the European and national levels, which provided comprehensive tools to drastically change the market structures. In addition, the regulation has contributed to the development of investments by considering different positioning of market players and the industry dynamics. The European Electronic Communications Code (EECC) in June 2018 aims to increase investment and innovation to the benefit of the society and particularly considers the emergence of Over the Top (OTT) platforms that have challenged the traditional telecommunications market.

The OTTs or digital platforms in general offer media and other services directly to consumers via the Internet. These platforms are an integral part of our modern lives including information source (e.g., Facebook, Google), entertainment (Netflix), goods purchases (e.g., Amazon, Alibaba), accommodation booking (e.g., Airbnb, Booking.com), access to digital ecosystems (e.g., Google Play, Apple Store), and so on. It is true that consumers do not always have to pay for consuming these services because the digital platforms are often two or multiple sided, and thus, they can generate revenues from advertising. This seems to amplify the positive effects of the digital technologies on the economy and consumers wellbeing.

The challenges of the technology development on society are also well known, such as data privacy concerns, environmental pollution and employment (Tirole, 2016, Spence, 2021). From the perspective of the ICT industry development, the growing digital platforms can pose stern problems for the sustainable development of European digital ecosystems, affecting related participants from telecommunication operators, potential entry of innovative platforms, and citizens.

Network operators argue that they have been spending large sums of money for several years to improve their investments in order to cope with the increased use of data, and that content providers are taking advantage of this and raking in large revenues by adjusting their business model, without contributing to these investments. Thus, operators are caught between European digital connectivity objectives, which require them to invest to support traffic and be able to deliver high quality services to consumers, and the difficulty

of monetizing network access, particularly by benefiting from a fair contribution from content providers for the costs they generate. The situation is now sufficiently contrasted for the European Commission and regulators to be more sensitive to the arguments put forward by the various parties involved.

Faced with this situation, network operators' revenues continue to be under pressure notably due to increasing competition in Internet access and from global players that offer alternative services. To keep up with investments, the operators claim that the European regulatory framework should provide a mechanism allowing for a fair contribution of content providers. Large content providers argue that they are already investing heavily, and that the solution put forward by the operators goes against the principles of the Open Internet regulation. The Digital Market Act (DMA), which entered into force in November 2022, establishes a framework that recognizes the domination of large online platforms that act as gatekeepers. But one should also address the issue of infrastructure financing and therefore the relationship between network operators and large content providers, the so-called large traffic generators.¹

Today, Europe is behind the leading Asian countries and the US with regard to the latest and faster Next Generation Access networks. Thus, the network operators should be provided with better possibilities to achieve the Digital decade objectives. In this context, it can be useful to lay down clear rules for large digital platforms that send excessive traffic over the network infrastructure to rebalance relationships with network operators, for the benefit of consumers and society at large. In particular, the fair cost sharing can be an extremely helpful mechanism to achieve those objectives. In the ongoing debate, content providers argue for the status quo, whereas network operators argue that it is an unfair situation, which finally harms end-users, and that content providers should contribute for the network costs. From a policy perspective, at least two main issues should be clarified. First, regulators would like to know who should be the gainers and losers if cost sharing policy is applied. More precisely, if the social welfare should increase as a result of cost sharing, and more specifically, the consumers are better off. The second issue is to check the veracity of a key claim of the content providers that under cost sharing, prices for digital services would be higher and quality lesser compared to when they are not required

¹Some believe that network operators cannot obtain sufficient return from costly investments because the European telecommunication industry is very fragmented as compared to what we could observe in the US (Cave, Genakos and Valletti, 2019). However, the consolidation issue is to be differentiated from the fair contribution of network costs.

to pay fees.

In the following, we take stock of recent economic literature to place it in an analytical framework and explain the incentives of different actors, considering different business models on the Internet, and how fair cost sharing might align with the European goal. Section 2 gives some insights on the dynamic relationships between network operators and digital platforms. The main point is to simply explain how the complementarity between access and content brings into play different effects that act on the incentives of network operators and content providers, which lead to pricing and investment decisions. Section 3 provides a comprehensive analysis of the potential impacts of cost sharing, and more precisely on how a contribution to the costs of networks could be effective to promote investments to the benefit of consumers and society at large. We also give more discussion and policy recommendations. Finally, section 4 offers some conclusive remarks.

2 Dynamic relationships between network operators and digital platforms

2.1 Some illustrative facts

For several months, there has been a growing debate in Europe about the funding of network investments. Telecom operators are calling for large digital platforms to participate in the financing of network investments. Indeed, they largely benefit from these investments by offering services that use network infrastructures, without however contributing to the costs they generate. This debate is not new, it emerged several years ago but the operators' arguments did not win over the regulators at the time. In recent years, disputes between operators and content providers have multiplied, in Europe, United States and also in Asia, with the issue of the free riding behavior of content providers.

Today, the context is significantly different. Axon's report (2022) indicates that more than half of the network traffic comes from very few content providers, while the very significant development of service offerings is leading to very strong traffic growth. This situation has led to a growing sense of unfair distribution of effort among the various players, reinforced by a significant difference between the network operators' revenues and those of large digital companies, but importantly, between their capitalizations. In particular, it is reported that the market capitalization and revenues of the large digital

platforms grew approximately four and five times during the 2017-2021 period while those of the European telecom operators decreased in the same period (Axon, 2022).

Regarding the investments, it is estimated that the telcos will need appropriately 150 billion euros to upgrade fixed infrastructure, and an additional 150 billion euros to fully roll out 5G network in Europe (Boston Consulting Group, 2021). On the other hand, the Big Techs, thanks to their massive business growth, can invest over 120 billion USD annually, but mainly on hosting (more than 90%) (Analysys Mason, 2022). These investments certainly benefit their consumers and help the Big Techs grow exponentially, however, they are not meant to replace the essential Internet's infrastructure. Indeed, Frontier Economics (2022) calculates that the total costs that OTT- driven traffic generated for the EU network operators in 2021 can be up to 40 billion euros, which is approximately one-sixth of their market capitalization (Axon, 2022).

2.2 Convergence of the Internet and business models

Over the last years, we have undoubtedly witnessed a fast convergence of technology and services. Until recently, in Europe, there were dedicated physical infrastructures for each digital service such as for voice, data, messaging services, access to the Internet, and other value-added services. Today, Internet allows providing many services that have previously been transported over these different separate networks. For instances, Skype or WhatsApp allow customers to make free calls domestically as well as internationally, while Amazon or Alibaba have grown tremendously and become the biggest global e-commerce. What is striking is that these platforms use the infrastructure provided by network operators to deliver content to users.² This development has led to a significant growth in traffic from users, which has required significant investment costs to meet quality objectives. In other words, the growth of large digital platforms can come at the expense of the network operators who are responsible for delivering data packages to consumers. Especially, some bandwidth intensive content and applications also require stable and relatively high quality of the network infrastructure. In this context, the European telecom sector is heavily regulated particularly in term of quality. Thus, the powerful digital platforms can turn the fragmented European telecommunication operators into mere infrastructure providers. As such, the convergence of the Internet gives rise to an asymmetrical situa-

²We remind here that building a separate network for that purpose is not socially desirable and unlikely privately profitable.

tion between network operators and digital platforms. This is reinforced by the different ability these actors have to define and adjust well their business models.

Digital platforms often adopt multiple sided business models. More precisely, unlike telecommunication industry, services offered by digital platforms generate little to zero marginal costs for them. Increasing consumption and data extraction can improve quality of content services offered by, for instance, the FANG (Facebook, Amazon, Netflix and Google) due to the positive within-side network externality (Belleflamme and Peitz, 2021). Thus, digital platforms often charge heavily the partner's side (e.g., advertisers as the case of Google and Facebook) while end-users can use the platforms free of charge or at modest cost. Furthermore, as showed in Casadesus-Masanell and Hervas-Drane (2015), competition in the digital market triggers platforms to raise subsidies to end-users to exploit further their data.

For their part, network operators often charge a fixed or multi-part tariff for each service (although bundling is also used) in the retail market only. This suggests that network operators should transform into multisided business models allowing them to monetize their customer bases and charge the partner's side including retailers, developers, and content owners.³ This however is difficult for the network operators mainly due to the imbalance of power between actors, namely the network operators and the content providers. Thus, commercial negotiation with partners such as powerful digital platforms can be easily broken down. If there is no change in the way of the relationships between operators and content providers are viewed, especially in the presence of large digital platforms, there is no clear signal that this current business model is viable and dramatically changes the position of the telecom operators in the near future.

2.3 Complementarity and investment

Content and access are one-way essential complements: end-users must access to the Internet to consume content services, but they do not need to consume content to be able to access Internet. Because of this, content providers and network operators can have different incentives to provide quality depending on, firstly, the cost of quality improving, and secondly, how they capture surplus due to a higher quality level. In the following, we dis-

³It should be reminded that the neutrality rules do not prohibit network operators from asking for a contribution to the digital platforms. They are mainly to prevent blocking or prioritizing access to content.

cuss how the complementarity between access and content should impact the investment incentives of network operators and content providers in the absence of regulation.

If we look first at the operators' incentive to upgrade the network quality, a tradeoff appears between two broad effects. First, investing in the network infrastructure including higher speed Internet or upgrading the bandwidth of existing connections is very costly. Second, regarding the revenue side, network operators are currently unable to charge large digital platforms for the improved quality due to their different market powers. In particular, content providers often refuse to pay, forcing all costs of delivering content traffics on consumers. Consequently, the network operators are unable to effectively allocate costs cross all sides, and thus their investment incentives can be highly different to the socially optimal level.

Looking at now the situation of content providers shows that their business models and cost structure are not the same as those of the network operators. Thus, their incentive to choose content quality can be different from the network operators' incentive to invest as follows. First, content can become increasingly more attractive due to positive network effects: users' utility increases with the number of users. For instance, users of Google or Facebook receive higher utility when more people join the platform because that will bring better data, connection. Similarly, buyers of Amazon or Netflix can receive more precise information, more recommendations... In this case, content quality improvement does not lead to an increase in the cost of the content providers. Certainly, they have a variety of levers to manage their services. They can invest in improving content quality (e.g., innovative services, heavily subsidize users to amplify positive network effects), or even network infrastructure (e.g., by CDN or advanced compression techniques). Despite the fact that these investments can benefit network operators, as less traffic are generated, content providers only invest up to the level to maximize their own profits. Second and relatedly, cost of supplying content can levy both on the content provider and the network operator. More precisely, a higher content quality implies greater consumption and thus a greater cost of delivering content to users. What matters here is that this cost is largely borne by network operators, but not content providers. So, content providers can be viewed as free riders. This leads to a classic negative externality problem that is not internalized here because there is no signal to raise awareness among content providers. On the revenue side, more attractive services allow two-sided content providers to charge higher price for end-users (service-based model) or advertisers (advertisement-

based model).⁴ These features suggest that content providers, that are able to monetize content, have clearly an incentive to over-supply quality because they do not bear all the cost (i.e. not fully internalize the negative externality) while they can (fully) earn money of it. In principle, a higher content quality can raise not only cost but also benefit for operators. When content is more attractive, this shifts upward the demand for network's due to the complementarity effect which makes a positive potential effect for operators. However, this positive effect is not enough to overwhelm the negative impact of the raising cost. Ultimately, network operators bear the cost without reaping the benefits as content providers, and this is detrimental for operators.

The above discussion highlights the conflicting situation that can arise when considering the incentive to invest to offer a high quality of digital services to end-users. The key point is about the negative externality, which, if there is no mechanism to internalize it, can produce significant harmful effects for development of the European telecom industry, consumers and possibly for all the society. In contrast, content providers can have incentive to invest in quality thanks to the positive network effects and their business models, but this negatively impacts the operators. In this context, operators and content providers might be willing to negotiate to internalize the negative externality. In practice, it has not been the case so far. This can be explained by few reasons. The first is related to the bargaining power imbalances: large content providers or Big Tech companies often have a very strong market positioning as compared to operators operated in the fragmented telecom market in Europe. Second, content providers argue that they are interested in investing in, for instance, CDN, compression techniques, and other video solutions, which partially and indirectly help to reduce global traffic. Yet, their effort is not enough as it is shown in the Axon's report (2022) that the video, social and gaming platforms alone account for over 70% of the global internet traffic which grew more than three times in just five years from 2017 to 2021. Finally, one may expect that the absence of a fair-cost sharing helps content providers because they can free-ride the network's infrastructure. In turn, this raises costs and makes it more difficult for operators to be viable, which limits network operators' investments, and therefore increases the difficulty of achieving the goals of the digital decade in Europe.

⁴See Anderson and Coate (2005) for an early work on this dimension. Furthermore, Ramon Casadesus-Masanell and Feng Zhu (2010) introduce a hybrid business model as the result of combining these two business models.

3 Impacts of cost sharing and policy recommendations

3.1 Cost sharing, investment and welfare

In this section, we examine how the introduction of cost sharing could modify the pricing and investments of network operators and content providers. As discussed above, the complementarity between access and content introduces externalities that should be internalized to drive efficient decisions by operators and content providers. The reality is that content consumption generates a cost to the network operator that could be reduced if the content provider produces an effort to contain its traffic. Without any other mechanism, the content provider could not internalize the external effects of the traffic they generate, leading to inefficient pricing and investment decisions and to a potential negative impact on both consumer surplus and social welfare.

A recent economic literature⁵ studies how cost sharing could change the incentives of network operators and content providers by making their pricing and investment decisions more efficient. Let's start considering a situation where a network operator sells access to users which can be combined with a content sold by a content provider. By introducing cost sharing, the content provider is made aware of the traffic cost it generates. This changes the prices that consumers face. Since a share of the network costs is then transferred to the content provider, consumers could benefit from a lower price for access. This positive effect however could be offset by the increase in the price for content that could be induced. It is unlikely however that total prices of access to the internet and content will exceed the level consumers paid in the absence of the fair cost sharing rules due to the following reasons.

First, each business model is unique to a company, but to clarify, a content provider's business model can be simply seen as its ability to generate revenue from advertising or to charge consumers directly for content. The former is referred to as an advertising-based model and the latter as a service-based model. The ability of a content provider to sell the consumers attention to advertisers lies on the efficiency of the targeting technology (e.g., capability to use data to deliver more personalized ads). This reveals the content provider's capability to monetize consumers. When the content provider is able to highly

⁵This topic has been recently study by Jullien and Bouvard (2022), and Jeanjean (2022).

monetize consumers, it becomes more sensitive to a decrease in demand. In such case, cost sharing gives incentives to the content provider to lower the cost of content for consumers and thus the overall price is lower. Hence, this effect reinforces the reduction in the total price that comes from the decrease in the price for access which corresponds to the share of the network cost transferred to the content provider. Finally, the decrease in the overall price shifts up the demand and at the end raises the consumer surplus and the social welfare.

In addition, cost sharing could produce additional positive impact on consumer surplus and social welfare through traffic moderation by the content provider. Indeed, it could be the case that the content provider benefits from traffic moderation. When its ability to monetize traffic is sufficiently high, the content provider produces high effort to contain traffic. The reason is traffic moderation lowers the network cost bearing by the operator and thus reduces the price for access which increases demand, even if traffic moderation could have a negative impact on the content quality. This clearly benefits consumers and also the network operator and content provider. Considering that some users can only consume access, all these positive impacts of cost sharing remain if the share of content consumers (i.e., who consume both access and content) is relatively high. So, cost sharing benefits content consumers but what is interesting to note here is that cost sharing can also benefit users who do not consume content because it reduces the price for access.

The ongoing debate on cost sharing also raises the question of the impact of cost sharing on the network operator's incentive to invest. Again, because of the complementarity between access and content, the impact of cost sharing on the operator's investment could be unclear. Indeed, as with traffic moderation by the content provider, the investment could have a positive effect on demand which is all the higher when the content provider is efficient in monetizing the demand. Obviously, the fair cost sharing rule encourages the content provider to moderate its traffic⁶, which then has two opposite effects on the operator's investment incentive. First, traffic moderation can be seen as a substitute for network investment since traffic moderation already allows demand to increase. In other words, there is a substitution effect between traffic moderation and investment by the operator, which affects the potential impact coming from the cost sharing. Second, cost sharing reduces the marginal cost of investment for the network operator, and thus, it has incentive to invest more. In this context, Jullien and Bouvard (2022) show that cost

⁶This can contribute to reduce the carbon footprint in European digital economy.

sharing could raise investment incentives of both the network operator and the incentives of the content provider to contain traffic when the latter has a sufficiently high ability to monetize its users.

The discussion above highlights the main effects of cost sharing when an operator faces a content provider, so we did not take into account on how competition may affect the potential benefit of cost sharing. However, competition both on access and content can modify the potential impacts arising when cost sharing is applied. Although, the economic literature on cost sharing is still recent, we can give some interesting insights into the effects of competition.

Let's first consider competition between network operators. It is obvious that competition between operators lowers the access price and increases demand. This benefits users and also content providers that can, in addition, raise their price (complementarity effect). Hence, cost sharing can amplify this positive effect, in particular, when content providers are able to monetize consumers at a high enough rate. This is simply explained when operators apply the same cost sharing. In this case, each operator reduces its price for two reasons: firstly, it bears a reduced share of the network cost (i.e. direct cost effect), and secondly, the competing operators lower their access price (i.e. strategic effect). Thus, competition between operators intensifies the potential positive effects of cost sharing both on consumer surplus and social welfare.

Let us now consider competition on the content side. The introduction of cost sharing for a content provider allows network operators to reduce the access price (complementarity effect). Thanks to this effect, cost sharing is beneficial to all consumers. However, the total price (access and content) is higher for consumers of the contributing content provider while all other consumers benefit from a lower total price. Again, cost sharing can increase consumer surplus if content providers are able to sufficiently monetize consumers, but, what is interesting now, is that this depends on the relative share of the contributing content provider's demand. That is, the content provider efficiency in monetizing should be higher when the relative demand of the contributing content provider is high. Thus, the result obtained by Jullien and Bouvard (2022) suggests that to improve consumer surplus, cost sharing should only be applied to large content providers, particularly those who can sufficiently monetize consumers.

3.2 Discussion and policy recommendations

After having discussed the main impacts of cost sharing rule, we now turn to the implications for regulation and give some recommendations. The methodologies to enforce such a policy need to reflect the dynamic relationship between network operators and content providers and complementarity between access and content.

Implementation of fair cost sharing rule

The growing consumption of content in Europe can both positively and negatively affects the network operators due to the fact that content and internet services are complementary. Thus, the sharing rule can only be considered to be "fair" if the rate can reflect the following aspects. First, the increased traffic can raise demand for the Internet service, and thus benefiting the network operators. The European network operators however cannot fully monetize this benefit with the current business model and unbalanced bargaining power with large content providers. In other words, although it can be a good thing for the operators to see growing traffic, it is unlikely that this will ever translate into high profitability. Second, the growing traffic however raises the costs of the operators because the digital platforms use the network infrastructure, free of charge, to deliver content to users. The marginal costs are likely increasing in traffic because it is more and more costly to improve the quality of the network infrastructure to meet the increased demand for the bandwidth. Finally, an effective rule must give sufficient incentive for the content providers to exert efforts to moderate traffic, and for the operators to increase their investments.

The implementation of the fair-cost sharing rule in practice raises several questions. The first is to determine what the criteria are and when the network operator should be compensated. Regarding this question, it is clear that the network operators should be compensated only if the traffic is excessively generated. The difficulty is to define what exactly an excessive traffic is. At first glance, one should consider the total traffic for each content provider and then define a threshold at which the cost sharing rule should be applied. However, traffic is not evenly distributed in time and this could lead to consider that cost sharing should only be applied to traffic at peak. This may change the timing of traffic, shifting traffic to off-peak hours. The second question is to define which content providers should contribute to the network costs. This is quite clear. The large digital

platforms, which generate excessive traffic, should contribute to the network cost. This suggests that imposing a traffic threshold on large digital platform can be appropriate in the context of the European digital economy. This might be specific to each platform depending also on its effort to moderate traffic. The last question is about which “fair” rate to apply. Beyond the threshold, a simple rate per unit of traffic can be adopted if the cost is known.⁷ In principle, the “optimal” rate should balance both the benefits and costs for the network operators due to the increased traffic.

Regulatory negotiation

Commercial negotiation is also common in business and effective, but it can become especially difficult due to the fragmented telecommunications market in Europe and strong market positions of the large digital platforms. Regulatory negotiation would bring together stakeholders, whose interests are divergent, and provide a framework for reaching consensus on the terms of cost sharing that is acceptable to all parties. This would allow oppositions to be resolved through the consultative and mediating role of designated bodies, rather than through legal confrontations that are ultimately costly for everyone. Thus, it is recommended to provide a concrete framework for both parties to join the negotiation, including the terms and solutions when one party cannot afford the other request. To encourage both parties to reach an acceptable agreement, the negotiation mechanism should provide for the modalities to be implemented in the event of a failure to negotiate, or if the negotiation takes too long to reach a conclusion.⁸

In the context of the European telecom sector, victims of excessive traffic generation are quite obvious. Furthermore, the cost to deliver content to end-users provided by different network operators is comparable. Thus, although one should be open to regulatory negotiation, it would be important to define beforehand the cost sharing rule that would allow a fair and efficient contribution to the network costs, and to address the bargaining power imbalances between European telecommunication network operators and large digital platforms.

⁷Frontier Economics (2022) calculates the total costs that OTT- driven traffic generates on EU network operators can be up to 40 billion euros.

⁸Recent experiences indicate that regulatory negotiation is a feasible solution. For instance, the News Media Bargaining Code, recently implemented in Australia, shows that it is possible to put in place a regulatory framework to facilitate negotiations.

Transparency

Whatever the solution, direct regulation of cost sharing or regulatory negotiation, transparency should be a major issue to watch out for. Because it is clear that the network operators are the stakeholders suffering from the excessive traffic, compensation should be directly paid to them rather than establishing a collective funds which is administratively costly.

To obtain the best from cost sharing collection and in light with the principles of Open Internet Regulation⁹, we suggest that a number of elements should be transparent when implementing the rule in practice. In particular, this involves allowing sufficient transparency regarding the use of the contribution collected with fair sharing, in order to build stakeholders confidence. The regulatory framework should facilitate negotiation, with the understanding that negotiation is to correct the “market failure” due to the negative externality generated by content providers for the European network operators. Either way, it should be made clear that the designed authorities should only implement the efficient cost sharing rule if negotiation between parties fails. That said, we can expect that the fair contribution of content providers would make it possible to align investments with connectivity objectives, and to the benefit of consumers.

4 Conclusion

There is a clear imbalance of resources and benefits between two main market players offering complementary services in the Europe’s digital economy: large digital platforms and network operators. Because access and content are complementary, an increase in content consumption raises the delivering cost to end-users, which is exclusively borne by network operators. Therefore, the increase in content consumption, which depends on the business model of content providers, leads to a negative externality that directly affects network operators. The externality however cannot be internalized because of the asymmetric market powers between the two parties. As a result, investment incentives by the two market players can be much lower than the socially desirable levels, potentially reducing citizen well-being, network infrastructure and innovations.

⁹See more on this regulation at: <https://www.berec.europa.eu/en/open-internet/what-transparencyrequirementsdoes-the-open-internet-regulation-introduce-for-isps>

For these reasons, an intervention is needed to correct market failure and ensure sustainable development of the Internet’s ecosystem. The recently proposed fair cost sharing mechanism can be a solution because large digital platforms must take into account and partially pay the actual cost of delivering content to end-users. Furthermore, a proper implementation of the mechanism can even encourage content providers to reduce their own price and optimize the total demand for digital services, thus with the addition of a potentially significant positive effect on the environment which would come to reinforce the benefits for consumers and the society at large.

Furthermore, we need to consider a number of aspects when designing and implementing the fair cost sharing rule in Europe including evaluation of the benefits and costs from the increased traffic, encouraging regulatory negotiation, defining an efficient rule in case of negotiation failure, and finally transparency regarding construction of a fair cost sharing rate and investments by all market players in the ecosystems.

Finally, the issues around a fair cost sharing mechanism in Europe shows a new and interesting research direction for researchers for both theoretical guidance and empirical aspects to ensure sustainable growth of the digital ecosystem. In this context, Big Techs can exert their market powers and pose threats for not only telecommunication operators but also other market entry with innovative solutions. Further research should be conducted and particularly be focused on the characteristics of an optimal regulatory policy that creates a level playing field for all market players.

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