

REPORT

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IMPLEMENTING CO-INVESTMENT AND NETWORK SHARING



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*Steffen Hoernig has worked separately on an industry report on the competitive effects of a network sharing agreement in the Belgian market. His work on this CERRE report was, however, carried out independently of his other commitments and has not influenced the content of this report.

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EXECUTIVE SUMMARY

The new European Electronic Communications Code² (the “Code”), which was adopted on December 11, 2018, introduces new regulatory provisions to stimulate investment in next-generation access networks and help to achieve the Gigabit Society targets for the European Union. One of the key new provisions is co-investment for very-high-capacity networks as an alternative to access remedies.

As of today, co-investment agreements for the deployment of fast broadband fixed infrastructures have already been implemented in a few European countries. In France, in urban and suburban areas operators are obliged by existing regulations to open to potential co-investors any new fibre infrastructure that they want to roll out, with different modalities for urban and suburban areas. In Portugal, the regulator has not set up similar obligations, but Vodafone and NOS struck a commercial co-investment deal in 2017 to share dark fibre for around 2.6 million homes. Co-investment agreements have also taken place in Italy, Spain and Switzerland. With the new Code, more co-investment agreements are likely to emerge.

In mobile markets, network sharing agreements are also very common, both mandated and voluntary, and can take different forms, ranging from sharing of cell sites to sharing of Radio Access Networks (RANs) and spectrum. The deployment of the new 5G mobile technology makes it necessary for operators to share even more of their infrastructure.

From a public policy point of view, allowing for infrastructure sharing – where infrastructure sharing encompasses both co-investment and network sharing – involves trade-offs. For example, infrastructure sharing allows operators to share costs – e.g., costs to upgrade or deploy networks, but also operating costs – which may improve their ability to invest, improve coverage and accelerate roll-out – a clear benefit. But, on the other hand, there is the concern that in certain circumstances infrastructure sharing agreements may harm competition, for example, by reducing infrastructure-based competition, and hence investment incentives, or by facilitating collusion between co-investors.

The market context (e.g., the market positions of the partners) is a strong determinant of the potential benefits and costs of an agreement. The implementation details of the agreement also matter. The general objective of this report is to discuss the implementation aspects of infrastructure sharing that may affect the trade-off between the benefits of infrastructure sharing, in terms of faster and wider rollout of high-speed networks in particular, and the potential downsides, in terms of reduced investment incentives or softened market competition. We studied the following Implementation aspects: the operational model adopted for infrastructure sharing, whether to regulate or leave the agreement to the market, the interplay between infrastructure sharing and other regulatory provisions, how to price access by late co-investors, and the specificities of infrastructure sharing agreements with business users.

Our methodology has been to rely on relevant economic literature to analyse the effect of infrastructure sharing, and its various forms, on market outcomes, in terms of levels of prices and investment in particular, and to investigate specific country case studies, with a focus on the relevant legal cases.

² Directive (EU) 2018/1972 of 11 December 2018 Establishing the European Electronic Communications Code.



Our analysis shows that from a social point of view, infrastructure sharing has the following potential benefits:

1. Sharing of deployment costs, leading to faster and wider coverage and higher quality;
2. Sharing of operational costs, leading to lower prices;
3. Enhanced competition, benefiting consumers in terms of lower prices;
4. Facilitated entry for third-party operators.

In the absence of infrastructure sharing, the counterfactual differs depending on the type of technology (fixed or mobile) and the market context (i.e., the dominance of partners). In the fixed market, with SMP operators, but also under the new co-investment provisions in the EECC, the counterfactual involves some access obligations. For fixed infrastructure sharing with non-SMP operators, where sharing occurs on a voluntary basis, the counterfactual would rather involve no access obligation. In the mobile market, the counterfactual situation would involve no access obligation and most (if not all) nationwide networks investing independently to upgrade their networks.

The potential drawbacks which may arise in certain circumstances are due to the potential unilateral effects and coordinated effects of infrastructure sharing:

1. Incentive and ability to raise internal and/or external access prices to soften price competition at the retail level;
2. Lack of freedom for differentiation from partners on roll-out and other independent strategies;
3. Reduced incentives for unilateral investment resulting in lower total network investment than would otherwise be the case;
4. Exclusion of potential rivals through entry-detering access conditions for non-partners;
5. Cost disadvantage for non-partners that are not allowed to join the agreement;
6. Cherry-picking/free riding from late co-investors, which could deter investment in the first place;
7. Risks of explicit or tacit collusion, stemming in particular from information exchange between partners.

The market context and the type of technology deployed (fixed or mobile) will affect the magnitude of each potential benefit and drawback listed above.

The implementation of an infrastructure sharing agreement will also affect the potential benefits and costs of infrastructure sharing. Therefore, we have analysed how an agreement should be implemented to maximize benefits, while minimizing potential costs.

The first, key, implementation aspect is the choice of an operational model, which can be a full joint venture, a reciprocal access agreement or a one-way sharing agreement.

We showed that there are trade-offs for firms and society between these different models.

For firms, joint venture arrangements, often involving the creation of a separate joint venture company, bring complementarities and synergies, imply strong commitment and allow for more coordination between partners, compared to contractual arrangements such as reciprocal access or one-way sharing. The latter type of arrangement, though, entails lower transaction costs, is more flexible and gives more incentives to operators to employ their specific know-how in the deployment and operation of networks.



From a social point of view, full joint ventures imply more total investment if there are strong investment spillovers between operators, and have also the benefit of bringing complementarities and synergies. By contrast, more limited contractual arrangements such as reciprocal access or one-way sharing are more conducive to investment if investment spillovers are negligible, facilitate the expansion and upgrade of the shared infrastructure, and limit the risks of unilateral or coordinated effects.

We argued that it is not the operational model itself, but rather the design of the agreement, which is crucial to avoid potential negative unilateral or coordinated effects.

In particular, in an agreement, we recommend that the following rules apply:

1. Access or transfer prices should not be set at excessive levels;
2. The strategic independence of each partner should be guaranteed;
3. In joint ventures, each partner should be allowed to offer wholesale access to the shared infrastructure, individually and independently;
4. Exclusivity provisions for entering the agreement should be kept to the minimum necessary;
5. The agreement should protect the investor against opportunism from late co-investors;
6. To minimize the risk of coordinated behaviour, each partner should retain its independence, information exchange should be kept to the minimum necessary, and termination rules should be detailed and explicit.

We also studied the following other implementation aspects of infrastructure sharing:

- When to regulate agreements, and when to leave them to the market;
- The interplay between infrastructure sharing and other regulatory provisions;
- Pricing of late co-investment;
- Infrastructure sharing with business users.

First, private incentives for infrastructure sharing do not necessarily coincide with the incentives for society. Thus, it may happen that an agreement will not emerge, whereas such an agreement would be socially desirable. In such a case, infrastructure sharing could be mandated (balancing the potential benefits and costs of such obligation). To avoid potential anti-competitive effects, infrastructure sharing agreements should be vetted, and subject to either *ex-ante* approval or *ex-post* assessment, with the list of important design features discussed above scrutinized.

Second, we argued that for fixed sharing, adding regulatory provisions that are substitutes for co-investment, such as access obligations, may promote opportunistic behaviour from entrants, reducing co-investment and ultimately harming investment. By contrast, regulatory provisions that complement co-investment, such as access to ducts and poles, facilitate co-investment and improve coverage.

Third, we discussed various methods to regulate late co-investment in the fixed market, in order to limit its negative impact on investment:

1. A partner that joins late could pay a "risk premium" for using the infrastructure;
2. Potential co-investors could buy a "co-investment option," i.e., the right to ask for co-investment later by making a payment when the first investment is made;
3. Potential co-investors could commit to buy some minimum capacity once the infrastructure is rolled out.



Fourth, the regulatory aspects of infrastructure cooperation with MNOs, third or neutral parties, and public-private partnerships, should be subjected to further study.

Finally, in this report, we discussed the experience in various European countries regarding mobile network sharing and fixed co-investment, with a review of the relevant legal cases when available.

Some general lessons can be drawn from the country cases:

- The drawbacks of infrastructure sharing discussed above are real concerns, and have been addressed in various cases;
- Very different forms and intensities of infrastructure sharing have taken place, and they are mostly considered successful;
- There is not one best form, but it is important to address the concerns that we discussed above when the agreements are designed.

The legal cases show that infrastructure sharing agreements are generally viewed favourably by competition authorities as fostering faster network roll-out and increased competition, and that there is not one single form of cooperation that is favoured by competition authorities.

The cases show that infrastructure sharing transactions, regardless of the form, must take the following anti-competitive effects into account (which largely overlap with the drawbacks highlighted above):

- The infrastructure sharing involving new network investment should result in more and faster total network roll-out, or more and faster network upgrades, than would otherwise be the case in the absence of cooperation.
- As a general matter, infrastructure sharing with limited geographic scope will create fewer competition concerns than sharing covering large parts of a country; sharing in rural areas will create fewer issues than sharing in urban areas.
- Sharing of passive network elements will raise fewer competition issues than sharing active network elements, such as RAN sharing.
- The pricing of wholesale inputs (passive and active infrastructure, maintenance services) should be analysed both with regard to their impact on the retail pricing strategy of the parties (the risk of price coordination), but also with regard to access prices charged to third party operators (risk of foreclosure).
- Where some party's incentives are not aligned with its contractual investment or maintenance obligations, there is a significant risk of anticompetitive behaviour regardless of what is written in the contract. Therefore, infrastructure sharing deals should be avoided or carefully scrutinized where there is a mismatch in incentives (for example, if one of the parties already has a cable network in a zone covered by the party's co-investment commitment).
- Restrictions to third party access to infrastructure should be eliminated or reduced to the strict minimum necessary for the infrastructure sharing involving new network investment to be viable.
- The competitive impact on third party operators of infrastructure sharing will also depend on the existence or not of regulated wholesale access remedies, as well as in co-investment projects the openness to further co-investors.
- Information exchange must be limited to what is strictly necessary, including if necessary the organization of internal Chinese walls.

01

INTRODUCTION

1. INTRODUCTION

The new European Electronic Communications Code³ (the “Code”), which was adopted on December 11, 2018, introduces new regulatory provisions to stimulate investment in very high capacity networks and help to achieve the Gigabit Society targets for the European Union. One of the key new provisions is co-investment for very high capacity networks in exchange for regulatory flexibility with regard to standard access remedies.

As of today, co-investment agreements for the deployment of very high capacity⁴ broadband fixed infrastructures have already been implemented in a few European countries. In France, in urban and suburban areas operators are obliged by existing regulations to open to potential co-investors any new fibre infrastructure that they want to roll out, with different modalities for urban and suburban areas. In Portugal, the regulator has not set up similar obligations, but Vodafone and NOS struck a commercial co-investment deal in 2017 to share dark fibre for around 2.6 million homes. Co-investment agreements have also taken place in Italy, Spain and Switzerland. With the new Code, more co-investment agreements are likely to emerge.

In mobile markets, network sharing agreements are also very common, both mandated and voluntary, and can take different forms, ranging from sharing of cell sites to sharing of Radio Access Networks (RANs) and spectrum. The deployment of the new 5G mobile technology makes it necessary for operators to share even more of their infrastructure.

In this report, we use the generic term **infrastructure sharing** to designate sharing of either fixed or mobile network infrastructure. For convenience, we use the term **co-investment** to designate sharing of very high speed fixed network infrastructure. We use the term **network sharing** to designate sharing of mobile network infrastructure, including in situations where the mobile network sharing involves new ex ante investment. Thus, *infrastructure sharing* encompasses both *co-investment* (i.e. sharing of fixed networks) and *network sharing* (i.e. sharing of mobile networks).

Co-investment for fixed networks and network sharing for mobile networks present some common features. However, there are also significant differences between fixed and mobile sharing, in particular with respect to the type of investment involved. When appropriate, we will highlight and discuss these differences.

From a public policy point of view, allowing for infrastructure sharing involves a trade-off. On the one hand, infrastructure sharing has clear efficiency benefits: it allows operators to share costs – e.g., investment costs, but also operating costs – which may improve their ability to invest in new infrastructure, improve coverage and accelerate roll-out. On the other hand, there is the concern that in certain circumstances infrastructure sharing agreements may harm competition, e.g., by reducing infrastructure-based competition, and hence investment incentives, or by facilitating collusion between co-investors in the downstream market.

A recent statement of objections of the European Commission on a network sharing agreement between O2 CZ, CETIN and T-Mobile CZ illustrates this complex trade-off.⁵ On this specific case, Commissioner Margrethe Vestager clearly outlined the trade-off between the potential benefits and costs of infrastructure sharing:

³ Directive (EU) 2018/1972 of 11 December 2018 Establishing the European Electronic Communications Code.

⁴ Very high capacity (VHC) networks are either fiber networks (at least up to the distribution point) or networks capable of delivering the same performance in terms of download and upload speed, latency, etc.

⁵ https://europa.eu/rapid/press-release_IP-19-5110_en.htm



"Operators sharing networks generally benefits consumers in terms of faster roll out, cost savings and coverage in rural areas. However, when there are signs that co-operative agreements may be harmful to consumers, it is our role to investigate these and ensure that markets indeed remain competitive. In the present case, we have concerns that the network sharing agreement between the two major operators in Czechia reduces competition in the more densely populated areas of the country."

The market context (e.g., the market positions of the partners) will affect the potential benefits and costs, but the implementation details of the agreement also matter. The general objective of this report is to study the implementation aspects of infrastructure sharing that may affect the trade-off between the benefits of infrastructure sharing, in terms of faster and wider rollout of high-speed networks, and the potential downsides, in terms of reduced investment incentives or softened market competition. Implementation aspects include the operational model adopted for infrastructure sharing, the geographic and technical scope of the sharing agreement, the interplay between infrastructure sharing and other regulatory provisions, how to price access by late co-investors, etc.

To study the impact of various implementation aspects of infrastructure sharing on its potential benefits and costs, our approach has been to rely on relevant economic literature to analyse the effect of infrastructure sharing, and its various forms, on market outcomes, and to investigate specific country case studies.

The rest of the report is organized as follows. In Section 2, we briefly review the legal context with respect to infrastructure sharing, both in terms of existing regulations and competition law. In Section 3, we discuss the pros and cons of infrastructure sharing. In Section 4, we describe three different operational models and discuss the trade-offs faced by firms and society between these models. In Section 5, we discuss different implementation aspects of infrastructure sharing. Section 6 covers country case studies and includes a discussion of relevant case law in each country. Section 7 concludes with a summary of our findings and recommendations.

02

INFRASTRUCTURE SHARING

THE LEGAL CONTEXT

2. INFRASTRUCTURE SHARING: THE LEGAL CONTEXT

2.1. Regulatory framework

The regulatory framework in the European Union starts from the premise that infrastructure-based competition should be fostered wherever possible. To permit infrastructure-based competition to emerge, the regulatory framework provides for two kinds of access remedies: symmetric access remedies that apply to all operators in the market regardless of their market power, and asymmetric access remedies that apply only to operators with significant market power (SMP). In addition, the regulatory framework imposes access obligations on certain non-operators (e.g. water or electricity companies) that control passive infrastructure (e.g. ducts or masts) useful for operators of electronic communications networks.

In addition to facilitating access for the purpose of fostering infrastructure-based competition, the regulatory framework permits access obligations to be imposed in order to facilitate coverage of rural areas, or for purposes of city or environmental planning (e.g. coordinating civil engineering works, or limiting the number of masts in cities). Access obligations may also be imposed in connection with frequency authorizations. Some of these provisions call for access or sharing to be achieved through commercial negotiations, with regulatory dispute resolution as a backstop in case negotiations fail. Obligations on SMP operators are more prescriptive, typically including a catalogue of precise access obligations and pricing principles.

When it comes to purely commercial sharing outside the framework of SMP regulation, the existing regulatory framework says little or nothing about the content of the agreements.

Some of the existing provisions of the electronic communications framework include the following:

- Article 12 of the Framework directive (Directive 2002/21/EC), both in its original version and its extended version following Directive 2009/140/EC, allows for the imposition of sharing of property and passive infrastructure in operators' electronic communications networks.
- Commission Recommendation 2010/572/EU ("NGA recommendation") states that in certain conditions, co-investment for fixed infrastructure may lead to effective competition in a certain area and thus the possibility to define a separate geographical market and a specific examination of SMP. Relevant considerations for this assessment include whether each co-investor "enjoys strictly equivalent and cost-oriented access to the infrastructure", "the co-investors are effectively competing in the downstream market", and that there is sufficient capacity in ducts for third parties. The NGA recommendation is the first time the European Commission tried to introduce positive incentives for co-investment by hinting that access obligations might be weakened as a result. The EECC takes this principle further.
- Commission Recommendation 2013/466/EU (Recommendation non-discrimination and costing methodologies) does not mention sharing agreements.
- Directive 2014/61/EU (Cost Reduction Directive) reiterates that in imposing access obligations, NRAs should, among other factors, take existing co-investment offers into account (considerandum 19).
- Finally, the EECC of 2018 contains the following dispositions concerning infrastructure sharing:

- Article 44 contains part of Article 12 of the 2002 Framework Directive, concerning to the possibility to impose sharing on the grounds of public interest reasons, plus restrictions on such impositions such as proportionality etc.
- Article 47 states that when conditions are attached to radio spectrum rights of use, these may provide for the possibility of sharing of passive or active infrastructure, commercial roaming, or joint roll-out of infrastructure. Sharing of radio spectrum shall not be ruled out in these conditions.
- Article 61.3 states that national regulatory authorities can impose obligations to share in-building fibre wiring, when duplication would be infeasible economically or practically.
- Article 61.4 states that competent authorities may impose the sharing of (passive and in extreme cases active) infrastructure using mobile spectrum, but only under strict conditions: the sharing must be absolutely necessary, and its possibility must have been foreseen in the conditions for rights of use.
- Article 76 provides that SMP remedies shall not be imposed, if co-investment agreements meet the criteria set out in this Article and Annex IV. In this context it is also relevant to note the clarification in considerandum 198 that purchase agreements only count as co-investment if they are of a structural nature and involve some co-determination.

2.2. Competition law

The competition law analysis of infrastructure sharing will be based largely on the Commission's guidelines on horizontal cooperation agreements, and on national and EU case law dealing with telecoms infrastructure sharing, examined in Section 6 below.

We discuss below, in general terms, the Commission's 2011 Guidelines on the applicability of Article 101 of the Treaty on the Functioning of the European Union ("TFEU") to horizontal cooperation agreements ("Guidelines"). The application of these principles to infrastructure sharing situations will be examined in connection with the legal case law, in Section 6.

Although they do not refer specifically to telecommunications agreements, the Guidelines remain one of the most important references for competition authorities when they consider infrastructure sharing agreements. The Guidelines' provisions on production agreements are particularly relevant for infrastructure sharing, so we will summarize briefly what they say.

Article 101 of the TFEU focuses first on whether the cooperation has an anticompetitive object or effect. If there is an anticompetitive object or effect, the cooperation can nevertheless be permitted if the net benefits for society and consumers, through increased efficiency, outweigh the anticompetitive effects, and the anticompetitive aspects are limited to what is strictly necessary to achieve the efficiency gains.

The existence of a likely anticompetitive effect must be determined by comparing the situation likely to result from the cooperation to the situation that would likely exist in the absence of the cooperation.

The Guidelines highlight the following competitive concerns with respect to production agreements:

- Coordination of the parties' competitive behaviour as suppliers may lead to higher prices or reduced output, product quality, product variety or innovation. This can happen in particular when the production agreement increases the parties' commonality of costs (that is to say, the proportion of variable costs which the parties have in



common) to a degree which enables them to achieve a collusive outcome, or if the agreement involves an exchange of commercially sensitive information that can lead to a collusive outcome. (Guidelines, point 158.)

- Parties to the cooperation could use the joint production to raise the costs of their rivals downstream and, ultimately, force them off the market. (Guidelines, point 159)

The restrictive effects on competition may be *small or non-existent* if the cooperation enables the parties to launch a new product or service, which, on the basis of objective factors, the parties would otherwise not have been able to do. (Guidelines, point 163.)

The respective market shares of the parties matter. In cases where a company with market power in one market co-operates with a potential entrant, for example, with a supplier of the same product in a neighbouring geographic or product market, the agreement can potentially increase the market power of the incumbent. This can lead to restrictive effects on competition if actual competition in the incumbent's market is already weak and the threat of entry is a major source of competitive constraint. (Guidelines, point 166.)

Commonality of costs increases the risk of a collusive outcome only if production costs constitute a large proportion of the variable costs concerned. A scenario where commonality of costs can lead to a collusive outcome could be where the parties agree on the joint production of an intermediate product which accounts for a large proportion of the variable costs of the final product with respect to which the parties compete downstream. The parties could use the production agreement to increase the price of that common important input for their products in the downstream market. This would weaken competition downstream and would be likely to lead to higher final prices. The profit would be shifted from downstream to upstream to be then shared between the parties through the joint venture. (Guidelines, points 178 and 179).

Once a counterfactual analysis shows that the cooperation is likely to have an anticompetitive effect, the burden of proof shifts to the parties to demonstrate that the cooperation generates efficiency gains that outweigh the anticompetitive effects, that consumers will obtain a fair share of the efficiency gains, and that the anticompetitive aspects of the cooperation are limited to what is strictly necessary to achieve the efficiency gains.

Production agreements can be pro-competitive if they provide efficiency gains in the form of cost savings or better production technologies. By producing together companies can save costs that otherwise they would duplicate. They can also produce at lower costs if the cooperation enables them to increase production where marginal costs decline with output, that is to say, by economies of scale. Producing jointly can also help companies to improve product quality if they put together their complementary skills and know-how. Co-operation can also enable companies to increase product variety, which they could not have afforded, or would not have been able to achieve, otherwise. If joint production allows the parties to increase the number of different types of products, it can also provide cost savings by means of economies of scope (Guidelines, point 183).

03

PROS & CONS OF INFRASTRUCTURE SHARING

3. PROS AND CONS OF INFRASTRUCTURE SHARING

Regulators and competition authorities usually see both benefits and costs associated with infrastructure sharing. We first present the potential benefits and costs of infrastructure sharing discussed in reports published by the BEREC and the OECD. Then, we rely on a microeconomic analysis of competition and investment in network infrastructure to balance the potential positive and negative effects of infrastructure sharing and determine its possible “net” effect. Finally, we discuss the possible anti-competitive effects of infrastructure sharing, distinguishing between unilateral and coordinated effects.

3.1 Potential benefits and costs of infrastructure sharing in BEREC (2019) and OECD (2014)

The OECD (2014) and BEREC (2019) reports focus on *mobile* infrastructure sharing, but we believe that their analysis is general enough to provide insights on *fixed* infrastructure sharing as well. We summarize below the benefits and drawbacks of infrastructure sharing according to these reports. Given their focus on mobile sharing, these benefits and drawbacks are defined with respect to a counterfactual situation with independent investment and no access obligation (we will discuss below the different possible counterfactuals, depending on the technology and the market context).

Benefits of infrastructure sharing

BEREC (2019) lists four potential benefits of infrastructure sharing:⁶

- Cost reductions;
- Improved efficiency;
- Enhanced consumer choice;
- Environmental benefits.

Potential cost reductions concern both fixed costs and variable costs, and the magnitude of the cost savings may depend on the specific context and the network design. For example, BEREC argues that active sharing may lead to larger cost savings than passive sharing. When cost reductions concern variable costs (e.g., lower maintenance costs⁷), some of the cost savings may be passed through to consumers in terms of lower prices, depending on the level of competition in the product markets. When they relate to fixed costs (e.g., costs of upgrades or new deployments), one could argue that cost savings increase investment incentives and lead to faster and/or wider rollout, though, curiously, BEREC does not make this point.

BEREC (2019) indicates that improved efficiency may originate from more efficient use of spectrum, which requires spectrum sharing, a solution ruled out by most regulators though, probably because it is very complex and reduces possibilities of differentiation. Infrastructure sharing may also allow firms to reduce the overall transaction costs associated with the deployment of the network. For example, it is less costly to ask for authorizations from local authorities once rather than multiple times. This is particularly important for active RAN sharing, due to short innovation cycles.

To the extent that infrastructure sharing allows service-based competition to emerge or persist (relative to a counterfactual without any form of access), consumers can benefit from a wider choice of service providers.

⁶ BEREC (2018) provides a similar list of potential benefits of infrastructure sharing, as identified by NRAs. They include: (i) cost savings and the acceleration of coverage, (ii) more consumer choice, (iii) better quality of service through spectrum sharing, and (iv) environmental benefits.

⁷ At least, for the variable part of these costs.



Finally, BEREC (2019) considers benefits in terms of “public interest,” which correspond mainly to the environmental benefits of having a single infrastructure rather than multiple ones.

OECD (2014) also discusses the potential benefits and argues that infrastructure sharing, in addition to environmental benefits, spurs investment and enhances competition, compared to a situation where each operator would invest independently. First, cost-sharing reduces the deployment costs for operators, which leads to increased network coverage. Pooling of network infrastructure also allows faster rollout. Second, the OECD argues that infrastructure sharing can lead to lower prices and more choice for consumers. If infrastructure sharing entails cost synergies (e.g., due to lower maintenance costs), and these synergies are passed through to consumers, final prices will be lower. Besides, infrastructure sharing may reduce barriers to entry, and hence, lead to a wider choice of service providers for consumers.

Costs of infrastructure sharing

BEREC (2019) lists three potential costs or drawbacks of infrastructure sharing:⁸

- Reduced incentives to invest and ability to compete;
- Increased coordination between participants;
- Reduced network resilience.

The argument of BEREC to explain why investment incentives may be reduced in certain circumstances is that “*any gains in service offering (relating, for example, to coverage, network quality etc.) [...] are likely to be shared with other parties.*” In other words, investment by one partner (in terms of coverage or quality) spills over to the other partners. Due to this externality, partners may under-invest compared to a counterfactual with independent investment. The ability to compete through investment may also be reduced to some extent.

Increased coordination between participants may have benefits in terms of reduced transaction costs (see above), but according to BEREC it also raises two types of concerns or problems. First, coordination at the network level may facilitate coordination in other dimensions, and hence, pose a risk of (tacit or explicit) collusion between partners. We will discuss this issue below in more detail. Second, there can be various coordination costs between partners (for example, for network planning).

Finally, another downside of infrastructure sharing is reduced network resilience. Having a single rather than multiple infrastructures implies that in case of problems on a given network, consumers cannot switch to another network. Of course, this argument supposes that without infrastructure sharing, multiple networks would be deployed, which may not be the case in the areas where infrastructure sharing is most likely to take place (typically, the non-densely populated areas) and that switching could happen faster than the network would be restored.

OECD (2014) discusses the potential costs of infrastructure sharing in terms of anti-competitive behaviour. We will discuss these possible anti-competitive effects at the end of this section.

In their report, BEREC and the OECD focus on *mobile* infrastructure sharing, but we believe that their analysis and the list of potential benefits and costs that they propose apply well to *fixed* networks as well. However, there are important differences between mobile and fixed networks, which may affect the magnitude of each potential benefit and cost of infrastructure sharing discussed above.

⁸ BEREC (2018) identifies the following drawbacks of infrastructure sharing: it may (i) hinder infrastructure competition, (ii) decrease investment and infrastructure competition for better coverage, (iii) reduce differentiation (in particular, with active sharing), and (iv) reduce network resilience.



Market structure will affect how much of the variable cost savings from infrastructure sharing are passed through to consumers. To the extent that mobile (downstream) markets are less concentrated than fixed (downstream) markets, these benefits will be of a larger magnitude for mobile sharing than for fixed sharing. Market structure will also affect dynamic competition in terms of network deployment and upgrades, and therefore, the benefits that can be expected from sharing of deployment costs. Here, the relation between market structure and investment incentives is more ambiguous, and it is not clear if these benefits will be higher with a more or less concentrated market.⁹

Another important difference between mobile and fixed is that investment takes a different form for each technology. Sharing of passive mobile infrastructure typically occurs *ex post*, once masts and sites have been deployed, which reduces the potential benefits in terms of enhanced investment incentives. For active mobile infrastructure, operators invest to upgrade their network capacity and cope with an increasing demand for speed. Coverage, by contrast, is driven mostly by various obligations, in particular spectrum license obligations. In the fixed market, operators invest to increase the coverage of their fibre infrastructure, but once deployed, no further quality upgrade is necessary.

In the end, the cost-benefit analysis will be done on a case-by-case basis, taking into the specificities of the market context.

3.2. Balancing the benefits and costs of infrastructure sharing

One limitation of the cost-benefit analysis proposed by BEREC and the OECD, as well as similar exercises in other policy reports, is that it is hard to conclude whether the benefits are likely to dominate the costs, or whether the reverse is true. Neither do these reports discuss how sharing agreements could be designed to alleviate concerns about potential anti-competitive effects. We will take this point up in Section 4.

In particular, in their discussion of costs and benefits that we have summarized above, it is argued that infrastructure sharing can reduce deployment costs, and therefore, improve investment incentives (a benefit), but at the same time it is claimed that infrastructure sharing can reduce investment incentives because of spillovers to partners (a cost).

To have a more conclusive assessment of the *net effect* of infrastructure sharing on competition and investment, we rely on the micro-economic analysis proposed by Bourreau, Cambini and Hoernig (2018) and those of other authors. We first discuss fixed sharing (co-investment) and then mobile sharing (network sharing).

Fixed co-investment

Bourreau et al. (2018) propose a game-theoretic model where a network operator decides on how much to invest in a new network infrastructure. In their model, investment corresponds to a coverage decision, which fits well the case of fixed networks: the operator decides which areas of a given country to cover with the infrastructure (e.g., fibre), with some areas being cheap to cover, while others involve increasingly high deployment costs.

The authors consider a specific model of infrastructure sharing, the (mandatory) one-way sharing model as in France (see Section 4 for a discussion of the different models for infrastructure sharing): the network operator is required to accept any co-investment request from third parties. In the model, there is only one potential co-investor (the “entrant”), which

⁹ In its 2019 report, BEREC recommends to consider the market structure and the technologies involved, as well as the geographic scope and the time frame of the agreement to assess the benefits and costs of infrastructure sharing agreements.



decides in which of the areas covered by the incumbent it would like to co-invest. When there is co-investment in a given area, the two operators share the investment cost of the area and there is no further variable access fee to use the infrastructure. The authors also assume that the operators can set different quality-adjusted prices in different areas, depending on local competitive conditions. In the market equilibrium, after firms have made their pricing and investment decisions, three types of areas emerge: (i) areas with low deployment costs, where co-investment occurs and there is service-based competition ("black areas"), (ii) areas with intermediate investment costs where the incumbent invests but there is no co-investment ("grey areas"), and (iii) areas with no investment at all ("white areas").

To determine the impact of co-investment on competition and investment, one needs to define the relevant counterfactual or benchmark. The authors consider that in the absence of co-investment, a standard access regime would apply where the entrant would have access to the incumbent's infrastructure against a regulated access fee (for example, in the form of a bitstream access obligation).¹⁰ The authors then show that compared to a standard access regime, co-investment leads to:

- Increased total coverage, and hence, expansion of the "grey areas" towards costlier areas: this is because, in the costlier areas, the entrant will not co-invest, increasing the return of covering these costly areas for the incumbent compared to the benchmark with access.
- Expansion of the areas with service-based competition ("black areas") if the access price is set not too high by the regulator in the counterfactual with access: this is because, while competition is slightly stronger with co-investment as it is with regulated access, due to a very low implicit access price, the deployment costs are shared in the former case, which makes it profitable to expand black areas.
- Lower prices for consumers in "black areas": this is because, with co-investment, the implicit access price is equal to the marginal cost of access, and typically lower than the regulated access price in the benchmark situation.

To sum up, compared to a standard access regime, co-investment increases investment in network coverage and leads to lower prices for consumers in the areas with service-based competition. Synergies, in the form of lower maintenance costs or lower transaction costs, would reinforce the merits of co-investment compared to a traditional access regime, by leading to even lower prices for consumers.

Nitsche and Wiethaus (2011) undertake the same exercise, but focus on a different model of infrastructure sharing – the joint venture model without access payments (see Section 4). They compare sharing with a joint venture to two standard models of access pricing: fully distributed costs (FDC), where the incumbent can recoup its investment cost through the access price, and LRIC. Similar to the results obtained by Bourreau et al. (2018), they find that infrastructure sharing leads to higher consumer surplus compared to these two access regimes.

We are aware of only one paper that attempts to provide empirical evidence on the effect of co-investment on investment and competition, the study by Aimene, Lebourges and Liang (2019). The authors use data on the deployment of FTTH and co-investment in French municipalities in the period 2015-2018. Thus, the authors evaluate the impact of the French model for co-investment (mandatory one-way access). They find that co-investment does not affect the

¹⁰ The authors also consider the case where no operator is subject to regulatory obligations and study the conditions under which co-investment can emerge as a market outcome; see our discussion in Section 5.1.



share of households covered with FTTH in a given municipality. However, co-investment is associated with a higher take-up for FTTH services and leads to stronger service-based competition in co-investment areas (when co-investment occurs, the market share of the incumbent operator, Orange, decreases by 5.8%). These empirical findings seem consistent with our micro-economic analysis.

When the counterfactual involves no access obligations

In the discussion above, we have considered that in the counterfactual situation without infrastructure sharing, a standard access regime would apply. It seems to be the relevant benchmark when considering fixed infrastructure sharing with SMP operators, also under the new co-investment provisions in the EEC. However, for fixed infrastructure sharing with non-SMP operators, where sharing is typically not mandated but occurs on a voluntary basis, the counterfactual would rather involve no access obligation.

Using the same framework of Bourreau et al. (2018) described above, where an incumbent invests in a network infrastructure and an entrant can ask to co-invest, we can compare the outcome with co-investment to a counterfactual without access where the two operators invest independently in their own infrastructure. Compared to this alternative counterfactual, we find that infrastructure sharing:

- Does not affect total coverage, and hence, the size of the “grey areas.” This is because, in the costlier areas, only one firm finds it profitable to invest, whether there is infrastructure sharing or not.
- Expands the areas with service-based competition (the “black areas”). This is because, with infrastructure sharing, each firm bears only half of the deployment costs in these areas, which makes it profitable to expand black areas. Some areas, which were “grey areas,” become “black areas,” and in these consumers benefit from a wider choice and lower prices.

Therefore, the net effect of co-investment is positive, relative to both the benchmark with standard access obligations and to an alternative benchmark without such obligations.

Mobile network sharing

The analysis above may apply to the mobile market to some extent when investment involves the deployment of a new mobile technology, for example, 5G, in geographic areas. Our analysis would then suggest that sharing leads to faster and broader coverage of the new mobile technology.

However, in many cases, investment in mobile infrastructure will take a different form and correspond rather to the upgrade of existing infrastructure, with almost full coverage.

The counterfactual situation for the mobile market is also different. First, there would be no access obligation absent sharing. Second, in most mobile markets, there are 3 or 4 nationwide networks, and in the absence of sharing, some (if not all) of them would invest independently to upgrade their networks.

A recent theoretical contribution by Motta and Tarantino (2017) provides some insights into how network sharing would affect prices and investment in this type of market. In their study, the authors focus mainly on the impact on investment of a merger between two firms in an oligopolistic market. They consider cost-reducing investment but show that this is equivalent to quality improving investment under some conditions, which fits well with the type of



investment done in the mobile market for quality or capacity upgrade. As an extension of their baseline model, they also study the impact of a network sharing agreement between two firms in an oligopoly on prices and investment. This agreement corresponds to a joint venture; the firms coordinate their investments but compete in prices. They find that compared to a benchmark with independent investment (which is the proper benchmark for the mobile market), a network sharing agreement leads to lower prices and higher investment, and therefore, increases consumer surplus. Therefore, with a different counterfactual and a different form of investment, they find results that echo those obtained by Bourreau et al. (2018).

In a recent paper, Maier-Rigaud, Ivaldi and Heller (2020) provide empirical evidence on the impact on prices and investment of a network sharing agreement for 4G in the Czech Republic. First, using a difference-in-differences approach, they find that the network sharing agreement led to a reduction of prices in the Czech Republic compared to a control group of other European countries. Second, using a structural model of demand and supply for mobile services, they find that network sharing has led to lower costs and increased network quality.

We can draw the following lesson from the literature on the net effect of infrastructure sharing, which applies well to both the fixed and the mobile markets:

LESSON FROM THE LITERATURE ON THE NET EFFECT OF INFRASTRUCTURE SHARING

Lesson (the positive net effect of infrastructure sharing on investment and competition): Compared to the relevant counterfactual (which differs for the fixed and mobile markets), infrastructure sharing yields higher investment, either in coverage or quality depending on the market context, and stimulates competition in areas with service-based competition, leading to lower prices for consumers.

Since the net effect of infrastructure sharing seems positive, the drawbacks of infrastructure sharing accrue mainly from possible anti-competitive behaviour, as discussed by OECD (2014).

3.3. Potential anti-competitive effects of infrastructure sharing

We distinguish possible unilateral and coordinated effects of infrastructure sharing, as discussed in OECD (2014). For the moment, we abstract from the remedies that can be implemented in the design of infrastructure sharing agreements to cope with these concerns as well as constraints of competition law. We will discuss them in the next section on operational models (Section 4) and in the section on legal lessons (Section 6). Note also that the competitive constraint from non-sharing operators can mitigate these potential anti-competitive effects.

Unilateral effects

Infrastructure sharing agreements may entail unilateral effects.

First, partners in a cooperative agreement may have the incentive and ability to raise final prices through the design of the agreement. For example, partners could agree on high reciprocal access prices (or transfer prices in a joint venture, see below) or high external access prices to access seekers to raise final prices and soften competition at the retail level. This would be, of course, harmful for consumers.



Second, being part of the agreement by itself could weaken the partners' individual incentives and ability to compete and improve their services. This could happen for various reasons depending on the design of the agreement, such as fewer possibilities for independent service innovation and differentiation or lack of freedom for further unilateral investment. If investment incentives between the parties are not aligned, one of the parties may be able to hold back the others, slowing the others' pace of investment.

Third, the partners of an infrastructure sharing agreement may have the incentive and ability to foreclose potential competitors from using the network. For example, the partners in a network joint venture may agree on very high access prices for outsiders, which may lead to their exclusion. They may also ask for large commitments from outsiders (e.g., in terms of number of lines to co-finance), raising barriers to entry of competitors who are unable to build their own infrastructure.

Fourth, to the extent that infrastructure sharing agreements allow firms to reduce deployment and/or maintenance costs, if some operators enter these agreements but not all, the latter could be at a cost disadvantage with respect to the former, weakening their competitive position, if they were barred from participating in the agreement.

Fifth, and finally, when infrastructure sharing is the result of a regulatory obligation, and there is uncertainty about the profitability of investment, potential co-investors may have the incentive to wait until sufficient information becomes available, and thus, ask for co-investment "late", reducing investment incentives in the first place.

The possibility of unilateral effects depends heavily on the design of the infrastructure sharing agreement. In the next section, we will discuss rules to avoid these effects.

Coordinated effects

Anti-competitive effects can arise also due to the coordination between infrastructure sharing partners, depending on how it is implemented. Regulators and competition authorities are concerned that sharing of information on investment plans between partners might allow them to share information and coordinate in other dimensions too (e.g., prices or quantities), facilitating the implementation of a stable (explicit) collusive agreement. The possibility to establish collusion depends on the ability to monitor partners (for possible deviations from the collusive agreement) and to retaliate against any deviation.

With explicit collusion, firms coordinate to soften competition in the downstream market and increase their profits. For example, firms may agree on high downstream prices (to soften service-based competition) or reduce their independent investments outside the agreement (to soften infrastructure-based competition). Note that the latter type of harm, which is a consequence of the coordination between firms, is different from the unilateral harm that arises when the agreement commits partners to invest only in the joint venture.

Collusion is a standard concern for competition policy when competing firms make horizontal agreements, such as R&D joint ventures or input joint ventures. Sovinsky and Helland (2018) provide empirical evidence that R&D joint ventures can serve a collusive function. They show that the revision of antitrust leniency rules in the 1990s in the US, which aimed at destabilizing collusive agreements, was followed by a significant drop in the probability of joining a research joint venture (RJV) (e.g., a 34% drop for telecommunications firms). They interpret this drop as evidence that some RJVs are formed to facilitate collusion.



Of course, there are key differences between research joint ventures and joint ventures for the deployment and operation of a network infrastructure.¹¹ However, this work by Sovinsky and Helland highlights the possibility that coordination in one dimension (in their work, R&D) can facilitate coordination in other dimensions.

Krämer and Vogelsang (2017) ran a laboratory experiment to assess the propensity to collude in infrastructure sharing agreements, with the telecommunications context in mind. They found that communication between players when planning their infrastructure investments facilitated collusion at the retail level, but did not lead to more investment in their experiment.

The design of the infrastructure sharing agreement may facilitate collusion. As we will discuss in the next section, simple rules, for example with respect to information sharing, can reduce the risks of collusion. The type of sharing matters too. With passive sharing, for example, there is more scope for differentiation between partners and less risk to share sensitive information.

Infrastructure sharing may affect not only the propensity to collude explicitly, due to the possibility of information sharing and coordination, but also the likelihood that tacit collusion in the downstream market can emerge.

Some economic literature investigates whether the formation of RJVs makes tacit collusion more likely.¹² Miyagiwa (2009) shows that an RJV facilitates collusion (compared to a benchmark situation with independent R&D) in a setting where two firms undertake process R&D. This is due to the symmetric cost structure resulting from joint R&D efforts as opposed to the case where firms engage in a patent race that results in asymmetric costs. This is a general idea in the literature on tacit collusion: symmetry makes collusion more likely to emerge. Therefore, one might argue that infrastructure sharing, by giving participating firms a similar cost structure, can facilitate tacit collusion.

Taking on a different aspect of RJVs than the associated cost structure, Lambertini et al. (2002) focus on product innovations, and consider that RJVs result in identical products for the participating firms. By restricting firms' ability to differentiate their products and forcing them to compete more directly, an RJV then makes tacit collusion less likely to emerge. Applied to the context of our setting, this analysis suggests that the effect of infrastructure sharing on the likelihood of tacit collusion depends on how it affects firms' costs and product differentiation. For example, one can argue that sharing of passive infrastructure is likely to affect less service differentiation than active sharing.

As discussed by Bourreau et al. (2018), the possibility of explicit or tacit collusion may involve a trade-off from a social point of view between static efficiency and investment incentives: on the one hand, collusion leads to higher prices, and thus, lowers consumer welfare; on the other hand, firms make larger profits, which may enhance their investment incentives.¹³

¹¹ We are not aware of any empirical study looking at the impact of infrastructure sharing on collusion.

¹² Once again, there are key differences between RJVs and infrastructure sharing agreements. However, this literature provides some general insights that are useful to understand the effects of cooperation in a broad sense on tacit collusion.

¹³ This analysis assumes that there are only two operators that collude, and thus, can act as a monopoly for both pricing and investment decisions.



Summary: benefits and concerns of infrastructure sharing

We summarize the potential economic benefits and concerns associated with infrastructure sharing in the table below.¹⁴

As discussed in this section, infrastructure sharing has benefits in terms of investment and competition, and the drawbacks accrue mainly to potential anti-competitive effects. However, as we will discuss in the next section (see Section 4.3), a proper design of the agreement can address these concerns. If this is the case, the potential costs of infrastructure sharing will be minimized, making infrastructure sharing a clear benefit from a social point of view.

¹⁴ This table is a summary of our analysis, and does not aim to be a comprehensive checklist. There might be other economic or non-economic benefits or concerns associated with infrastructure sharing. For example, sharing of passive mobile infrastructure may have environmental benefits, a non-economic benefit.

THE BENEFITS AND DOWNSIDES OF INFRASTRUCTURE SHARING: A CHECKLIST

Potential benefits of infrastructure sharing

1. Cost-sharing for deployment costs, synergies, and gains from coordination imply faster and wider coverage and higher quality;
2. Sharing of maintenance and operational costs (e.g., OPEX) may lead to lower variable costs, and thus, lower prices (depending on pass through);
3. If internal access/transfer prices are lower than they would be with standard access obligations, stimulates competition in areas with service-based competition, benefiting consumers in terms of lower prices;
4. Can facilitate entry of third-party operators by permitting them to offer broad coverage and services from the outset while they deploy their own infrastructure. This is the objective of most SMP regulation, as well as commercial mobile network sharing agreements between an established MNO and a new entrant.

Potential concerns in terms of potential anti-competitive effects

Unilateral effects

1. Raising internal and/or external access prices to soften competition at the retail level;
2. Lack of freedom for differentiation from partners, unilateral investment, and other independent strategies;
3. Lack of incentives for unilateral investment or hold-up strategies resulting in lower total network investment than would otherwise be the case;
4. Foreclosure: exclusion of third-party potential rivals through entry deterring access conditions for non-partners (e.g., prohibitive access prices, too high commitments, etc.);
5. Cost disadvantage for non-partners that are not allowed to join the agreement;
6. Cherry-picking from third parties (late co-investment, etc.), which could deter co-investment agreements in the first place.

Coordinated effects

Risks of explicit or tacit collusion, linked to:

- Possibilities to implement explicit collusion, depending on the possibilities to exchange information and to coordinate on more than joint investment plans.
- Possibilities to implement tacit collusion depending on partners' ability to: (i) coordinate on a collusive 'agreement', (ii) detect deviations from the agreement, and (iii) punish deviations. Thus, incentives and feasibility of collusion depend on how competition between partners and non-partners works, which can be influenced by the design of the infrastructure sharing agreements, including the cost-sharing rules, possibilities to set transfer prices, possibilities to invest outside the agreement, as well as the competitive conditions in that market.

04

**OPERATIONAL
MODELS FOR
INFRASTRUCTURE
SHARING**

4. OPERATIONAL MODELS FOR INFRASTRUCTURE SHARING

Three main operational models are observed in Europe for infrastructure sharing (Berkeley Research Group, 2017):¹⁵

- Joint ventures between operators;
- Reciprocal access;
- One-way sharing.

In the joint venture model, co-investors create a common, legally independent entity, which manages the roll-out of a joint network and then operates and maintains the infrastructure. The network itself may be owned by the joint venture or separately by its partners. Access to third parties may be provided either by the joint venture or by the partners. Joint venture partners can bring various sorts of assets, including financing or network components, and may have symmetric or asymmetric shares in the joint venture. The joint venture model creates a high degree of coordination at the technological level and increases the partners' clout towards equipment providers.

Examples of this model for fixed infrastructures include the joint venture between Telecom Italia and Fast Web in Italy for the deployment of fibre (Flash Fiber) and the joint venture between Reggefiber and KPN in the Netherlands; see the case studies on Italy and the Netherlands in Section 6. For mobile infrastructure sharing, examples include the deployment of a joint mobile network in Denmark by Telenor and Telia and the Shared Rural Network in the UK, which is a deal between the four operators EE, O2, Three and Vodafone and the UK government to deploy a jointly owned network in rural areas; see the case study on Denmark and the UK in Section 6.

In the **reciprocal access** model, each co-investor deploys its own network infrastructure, typically in a specific geographical area, and then co-investors obtain access to each other's infrastructure. The extent of coverage may be decided jointly by partners in their cooperation agreement. Reciprocal access models are attractive when partners have regional preferences or can build on previous infrastructure. Examples of reciprocal access for fixed infrastructures can be found in Spain (Jazztel/Telefonica, Vodafone Spain/Orange), Portugal (Altice/Vodafone Portugal and NOS/Vodafone) and Switzerland (Swisscom/local utilities); see the case studies on Portugal, Spain and Switzerland in Section 6. For mobile infrastructure, the agreement between T-Mobile CZ and CETIN in the Czech Republic, which was opposed by the European Commission through a statement of objections, involved sharing the country in two parts between the operators. In a similar way, in Spain, Orange and Vodafone allow their partner to roam on their network (see Section 6).

Finally, in the **one-way sharing** model, an operator invests in a network infrastructure and provides access to other operators through co-financing. Such arrangements are close to standard access, except that co-investors are typically charged an access fee which corresponds to a share of the (fixed) investment cost, and they commit to a long-term contract with the infrastructure owner. For example, "indefeasible rights of use" (IRUs) can be used, providing access to all the necessary network elements over the lifetime of the infrastructure.¹⁶ An example of this model can be found in France, where operators investing in FTTH networks

¹⁵ Berkeley Research Group (2017) explores only fixed co-investment, but we think that their typology applies well to mobile sharing too.

¹⁶ Note that IRUs can be used too in the reciprocal access model (e.g., this is the case in Switzerland).

in sub-urban areas are required to accept co-investment requests from other operators. For mobile infrastructure, operators in France are mandated to share their RAN and provide roaming in areas with limited mobile coverage (see the case study on France in Section 6).

Figure 1 below illustrates the three different operational models for infrastructure sharing.

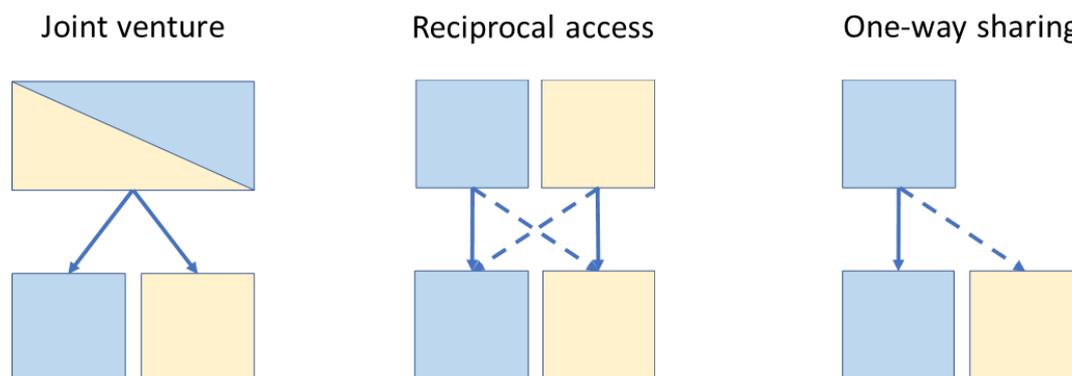


Figure 1: Models of infrastructure sharing (adapted from Berkeley Research Group, 2017).

Ownership of the infrastructure varies according the operational model. In the joint venture model, the founding partners jointly own the joint venture, possibly with asymmetric shares, which may or not own the actual infrastructure. Decisions for the infrastructure, in terms of maintenance, upgrade, etc., are taken based on the governance rules of the joint venture. In the reciprocal access model, each operator owns the infrastructure that it has deployed; there is no joint ownership. Finally, in the one-way sharing model, the initial investor owns the infrastructure, but co-investors may have some control rights. For example, this is case for IRUs, where co-investors have some guarantee of long-term use. The infrastructure owner is responsible for the maintenance of the infrastructure, and can decide on possible upgrades or expansions.

How do these different operational models compare? In particular, we are interested in how they compare in terms of the *benefits* and *drawbacks* of infrastructure sharing discussed in the previous section. Indeed, as BEREC (2019) states, "[t]he exact nature and impact of these benefits/drawbacks will depend on the type of sharing agreement and the market context."

We start by reviewing the economic literature on infrastructure sharing to obtain some insights on the advantages and drawbacks of each model as they are portrayed, usually in a simplified setting, in the economic literature. Then, we discuss the trade-offs for firms and for society between the different operational models. This discussion points the way to evaluating the actual design options that are followed in practice and that address the main concerns about infrastructure sharing.

4.1. Comparison of operational models: a literature review

A few papers in the economics literature propose a comparison of operational models for infrastructure sharing in simplified settings.

Cambini and Silvestri (2013) compare different stylized operational models for infrastructure sharing in a duopoly: (i) joint venture with transfer pricing, (ii) joint venture or one-way



sharing with cost sharing, and (iii) a standard access regime. They build a game-theoretic model with two firms: an incumbent firm that invests in improving the quality of its network infrastructure, and an access seeker. In the joint venture model with transfer pricing, the authors assume that the partners choose the level of the internal transfer price (i.e., the access price that they have to pay to use the joint infrastructure) in order to maximize joint profits. They show that partners have an incentive to set high transfer prices to raise final prices. By doing so, firms soften competition and can earn higher profits, which corresponds to the first unilateral effect that we discussed in Section 3 (in their model, there is no external competition that would mitigate this effect). By comparison, in the cost-sharing model, by definition the transfer price is set equal to the marginal cost of usage. Competition is more intense for given investment levels as the implicit access price between the firms is equal to marginal cost. In terms of investment, the cost-sharing model leads to more investment than the standard access regime, because firms share the investment cost. However, the joint venture model with transfer prices leads to higher investment than one-way sharing with cost-sharing because the higher transfer price raises profits. Thus, the authors identify a trade-off between investment (which would favour models with transfer pricing) and competition (which would favour models with cost-sharing). However, consumer surplus is always higher with cost-sharing.

This paper brings a number of interesting insights, in particular: (i) the trade-off between competition and investment depends on the level of transfer prices, and (ii) from a social point of view, cost-sharing is preferable to the joint venture model when firms can set transfer prices in the latter case in order to soften competition.

Inderst and Peitz (2014) highlight a similar trade-off as Cambini and Silvestri (2013) between competition and investment in the design of infrastructure sharing agreements. In their model, investment corresponds to a quality improvement of a network technology, but there is uncertainty about whether consumers will value this quality improvement (in terms of increased willingness to pay). They show that when the leading firm in the investment project can freely set the access price, it chooses it at a high level in order to reduce competition and increase retail prices (This is the classical problem of high wholesale prices under standard access). As a result, industry profits are higher and investment incentives are increased, but consumer surplus is lower.

Cambini and Silvestri (2013) also study the behaviour of the partners in an infrastructure joint venture with respect to third parties. They show that when there is a third party, the two incumbent firms that are partners in the joint venture may have an incentive to exclude the potential entrant by setting the external access price at a very high level, while setting the internal access price at a low level. Foreclosure of potential rivals, as described by Cambini and Silvestri, will be mitigated if the potential entrant has alternative means to enter the market (e.g., through bypass or access to alternative infrastructure).

We can summarize the insights from the economic literature as follows:

Lessons from the literature on the comparison of operational models: The literature suggests that the internal wholesale price set to access a shared infrastructure, rather than the operational model itself, has a decisive effect on both the level of infrastructure coverage and the resulting consumer benefits. In all three operational models, there can be incentives to set a high access or transfer price, which increases profits and coverage at the cost of lower consumer surplus. Therefore, all types of sharing

agreements should include design safeguards that commit partners to keeping transfer prices at a level that provides the correct trade-off between coverage and consumer surplus from a social point of view.

The literature points out that the partners in an infrastructure sharing agreement may have the ability and incentive to set high internal access prices to soften competition in the retail market or to foreclose competitors, but it does not consider how the design of these agreements could keep these incentives in check if external competition is not sufficient.

4.2. A comparison of the different operational models

The key dimension that differentiates the different operational models is the degree of coordination and joint control over the shared infrastructure. At one extreme, the joint venture model allows joint control of the infrastructure and a high degree of coordination.¹⁷ At the other extreme, with one-way sharing, there is a very low degree of coordination between firms, since the infrastructure is owned and controlled by the investing operator. Reciprocal access lies somewhere in between these two extreme cases: each operator controls its own infrastructure, but there may be some coordination between partners, for example, with respect to their respective exclusive territories. The formal structure of the cooperation matters little. For example, the parties may create a joint venture company but still allocate responsibility and control for network investments and maintenance to one or the other parties, thereby approaching a reciprocal or one-way access model.

In what follows, we start by discussing the trade-offs faced by firms when deciding on an operational model for infrastructure sharing, by contrasting the joint venture, which entails strong coordination, and reciprocal access or one-way sharing arrangements which allow firms to keep independent control of their infrastructure.

Trade-offs for firms

The main trade-off for firms between the different operational models is a trade-off between, on the one hand, the joint venture model and, on the other hand, contractual arrangements such as reciprocal access and one-way sharing. This trade-off is affected by the following factors:

- The importance of complementarities and synergies.

In a joint venture, partners join forces for the deployment and/or the operation of the infrastructure. To the extent that each partner has its own strengths, the joint venture can give rise to complementarities and synergies to the benefit of all partners. By contrast, with contractual arrangements such as reciprocal access or one-way sharing, each operator deploys its own infrastructure independently, while sharing it with partners. Therefore, complementarities and synergies (i.e., cost reductions which go beyond the savings from cost-sharing) cannot arise. Moreover, if economies of scale are present, the joint venture allows partners to achieve larger scale, and hence, lower costs.

- Transaction costs.

There are important transaction costs associated with forming, running, and possibly terminating a joint venture, due to the complexity of writing contracts and governing the joint organization. By comparison, contractual arrangements such as reciprocal access and one-way

¹⁷ Even if the joint venture is an independent subsidiary of the partner firms, those will have control rights over the joint venture, and therefore, the ability to coordinate on the strategic orientation of their joint entity.



sharing entail lower costs for partners. The literature on research joint ventures (RJVs) suggests that the transaction costs of forming a joint venture are particularly high when partners are different in size (which makes it trickier to align the interests of partners) and when they have little experience in running an RJV (see Röller et al. (2007) for empirical evidence).

Synergies and transaction costs highlight a first trade-off for firms between more cooperative organizational models, such as joint ventures, and more contractual ones, such as reciprocal access or one-way sharing. Synergies require a joint venture, which implies larger transaction costs. By contrast, with contractual arrangements, synergies (i.e., cost reductions which go beyond the savings obtained from cost-sharing) are absent or limited, but transaction costs are much lower.

- The benefits of commitment vs. flexibility.

As said above, a joint venture entails larger costs for establishing, governing and terminating the joint entity, compared to contractual arrangements such as reciprocal access or one-way sharing, which are more flexible forms of organization. Therefore, from the firms' point of view, there is another trade-off when choosing an operational model between commitment and flexibility. A joint venture represents a strong commitment from partners; joint control and the sharing of profits and costs may facilitate the alignment of interests of partners and reduce opportunism (see below). By contrast, contractual arrangements provide more flexibility to partners. For example, when technology changes at a high pace, firms in a contractual arrangement have more flexibility to decide on their technology upgrade for their own infrastructure.

- Risk of opportunistic behaviour.

In the context of R&D, Morasch (1995) argues that contractual arrangements, such as cross-licensing agreements, give rise to a double moral hazard problem. In his model, to the extent that R&D efforts are not observable, each partner in a cross-licensing agreement will make its R&D decision taking into account its own profit, but not the partner's profit. A joint venture makes R&D efforts observable, and, therefore, solves this moral hazard problem. In the context of infrastructure sharing, reciprocal access arrangements can be seen as the equivalent of cross-licensing deals for R&D. The double hazard problem highlighted by Morasch may arise if each partner in the reciprocal access deal makes its decision on infrastructure investment to maximize its own profit, without taking into account the effect on its partner. Misalignment of interests can result in a hold-up problem where one party to the cooperation slows the investment pace of the other party.

Pastor and Sandonis (2002) highlight another potential moral hazard problem for research joint ventures, which may make cross-licensing arrangements a more efficient form of organization. They consider the case where each partner can bring firm-specific "know-how" to the joint venture, which is an important factor of success for the venture. They argue that each partner then faces a trade-off for the disclosure of its know-how to the joint venture. On the one hand, it would make the joint venture more likely to be successful. On the other hand, it means providing important know-how to a market rival, which may itself free ride by not providing its own know-how. By contrast, a cross-licensing agreement protects each firm from the dissemination of its know-how to the partners. In an infrastructure sharing context, operators may be also concerned about the dissemination of important know-how or technologies to their partners, which are market rivals. This would push for arms-length contractual arrangements



such as reciprocal access or one-way sharing. Whether this is a relevant issue in telecommunications depends on whether operators have specific technology know-how.

- Possibilities of differentiation.

In the R&D literature, it has been argued that research joint ventures reduce the possibilities of differentiation for partner firms (e.g., see Lambertini, Poddar and Sasaki, 2002; Bourreau, Dogan and Manant, 2016), compared to a situation where each firm undertakes independent R&D. In the context of telecommunications networks, we could also argue that infrastructure sharing reduces the possibilities of differentiation, compared to a situation where firms roll out independent networks.

What matters is the ability for each partner to control network parameters to achieve as much service differentiation as they want. Therefore, the possibilities of differentiation seem significantly larger with passive sharing compared to active sharing. By contrast, it seems to us that the operational model has only second-order effects on possibilities of differentiation.

Trade-offs for society

From a social point of view, the different operational models for infrastructure sharing involve trade-offs in terms of competition and investment, as well as with regards to the risks of unilateral and coordinated effects, as discussed in Section 2.

Trade-offs for competition and investment

As discussed above, a joint venture implies a higher degree of coordination between partners for the deployment and/or operation of the shared infrastructure than contractual arrangements such as reciprocal access or one-way sharing.

The question is then how coordination affects competition and investment. The seminal treatment of this question in the economic literature was provided by d'Aspremont and Jacquemin (1988), in the context of cost-reducing R&D. These authors develop a theoretical model to compare the market outcome in terms of R&D investment and competition for three market organizations: (i) when firms undertake independent R&D and compete in the retail market, (ii) when they coordinate their R&D investments through a research joint venture, while still competing in the retail market, and finally, (iii) when they fully coordinate, for both their R&D decisions and their price or quantity decisions (i.e., they collude in the retail market). What is relevant for us is the comparison of the two first scenarios, (i) and (ii), from a social point of view. D'Aspremont and Jacquemin highlight two opposite effects of the coordination of R&D investments. First, with joint R&D, there is less pressure for the firms to get a competitive advantage over their rival. In other words, firms internalize the competition effect of R&D and tend to invest less. Second, d'Aspremont and Jacquemin consider the possibility that a firm's investment in cost-reducing R&D benefits partly its rival, which represents an R&D "spillover". Overall, d'Aspremont and Jacquemin show that cooperation in R&D is beneficial from a social point of view, in terms of investment and consumer surplus, if the degree of R&D spillovers is sufficiently high.

In the context of network infrastructures, Bourreau, Cambini and Dogan (2012) consider the possibility of "investment spillovers," that is, the possibility that when an operator rolls out its own network in a given area, the investment cost for later (rival) investors may be lower if they can benefit from the first operator's earlier efforts. For example, the first mover may have to ask for administrative authorizations from local authorities, which entail transactions costs. Once it has been done once, the transaction costs could be lower for later investors. Or, the



late movers may learn from the first mover early investment, and its “mistakes”, to reduce their investment cost.

Using the insights of d’Aspremont and Jacquemin’s analysis, we can conclude that operational models which involve a high degree of coordination, such as the joint venture model, are preferable to operational models with lower degrees of coordination, such as reciprocal access or one-way sharing, if investment spillovers are very strong thereby creating a strong alignment of interests. Otherwise, if investment spillovers are negligible or irrelevant, higher possibilities of coordination would entail less investment.

A second aspect to take into account is the magnitude of synergies that arise when a joint venture is formed, due to complementarities between partners (in terms of technology, capacity to operate a network, etc.). Strong complementarities or synergies for the deployment and/or operation of infrastructure would make the joint venture model more conducive to investment than the other operational models, everything else equal. The magnitude of potential complementarities or synergies will depend on each actual case. For example, in the case of sharing agreements between two established MNOs with nationwide networks the synergies will not relate so much to new deployment as to cost savings generated by site consolidation.

Finally, each model may affect differently how easy it is to expand or upgrade the shared network. With independent ownership (in the case of reciprocal access or one-way sharing), each firm can make its own decision about the expansion or upgrade of its network, except for the specific coverage commitments included in the agreement. By contrast, in the joint venture model, firms have agreed on a given investment plan and negotiating further expansion or a quality upgrade may entail significant transaction costs for the partners, unless the agreement foresees that partners can continue to invest independently. This is a primary concern for mobile sharing, where investment in upgrades is required constantly. More generally, where investment incentives are misaligned, any model can potentially result in a delay or hold-up of one partner’s investment if the investment depends in whole or in part on inputs from the other party.

Risks of unilateral and coordinated effects

As we have argued above, the main downsides of infrastructure sharing agreements stem from the risks of unilateral and coordinated effects.

More coordination between partners could in certain circumstances facilitate the adoption of the strategies that we have discussed in Section 3. For example, they would make it easier for them to implement high internal access prices to raise final prices and soften competition, to foreclose potential rivals, or to coordinate on more than their investment plans.

These concerns about potential unilateral and coordinated effects can be addressed by the specific design of agreements, as discussed in the next section, and are naturally targeted by competition law. These effects should also be assessed by taking into account the market structure. Potential harm to competition may be limited if the market remains very competitive after the infrastructure sharing agreement has been struck. For example, the type of concerns that we may have are very different if two large players agree on an infrastructure sharing agreement, and no significant independent player remains, or if two small operators form a joint venture and a third, large, operator remains outside of the deal. Where each of the operators in the market offers its services nationally (as is the case in many mobile markets), their competitive behaviour will be dictated largely by the intensity of competition in the most

densely populated areas. Where competition is intense in these densely populated areas, mobile network sharing in less populated areas would likely have a low impact on competition.

The following table summarizes our comparison of the operational models, contrasting cooperative arrangements (the joint venture model) and contractual arrangements (the reciprocal access and one-way sharing models).

COMPARISON OF OPERATIONAL MODELS	
Trade-offs for firms	
<i>In favour of cooperative arrangements (joint venture)</i>	<i>In favour of contractual arrangements (reciprocal access, one-way sharing)</i>
<p>Complementarities and synergies.</p> <p>Commitment.</p> <p>Partners coordinate more: less risk of opportunistic behaviour where each partner would take into account its own interest only.</p>	<p>Lower transaction costs.</p> <p>Flexibility.</p> <p>Partners remain independent: more incentive to use specific "know-how" for the deployment and/or operation of the shared infrastructure.</p>
Trade-offs for society	
<i>In favour of cooperative arrangements (joint venture)</i>	<i>In favour of contractual arrangements (reciprocal access, one-way sharing)</i>
<p>More investment if strong investment spillovers.</p> <p>Complementarities and synergies.</p>	<p>More investment if investment spillovers are negligible.</p> <p>Expansion and upgrade of shared network facilitated.</p> <p>Less risks of unilateral or coordinated effects.</p>

4.3. Design of infrastructure-sharing agreements

We now discuss how the design of agreements can address the potential concerns derived from stylized economic models and expressed in policy discussions, and discussed in the previous section. Note that the appropriate design of an agreement can occur at the initiative of the partners themselves, or be required by a competition authority or a regulator.

1. Access or transfer prices should not be set at excessive levels.

We have raised the concern that the joint venture model may have anti-competitive effects if partners can set high internal access prices. Therefore, just as under standard access agreements, it should not be possible to set access or transfer prices in sharing agreements at excessive levels. Under mandatory agreements, direct restriction on internal pricing can be imposed, while for market-driven agreements oversight from competition authorities may be necessary. Most importantly, internal pricing rules should be clearly identified in the agreement, so that their effect on market outcomes can be verified.

2. The strategic independence of each partner should be guaranteed.

A potential lack of incentives to compete or invest unilaterally can be the result of various aspects of the agreement.

- If partners do not have the freedom to independently design their services and set quality parameters, there are fewer dimensions in which they can compete. Therefore, the agreement should guarantee independence and control over which services each partner provides over the shared infrastructure.
- The spillovers between partners of service quality improvements (those not originated by the shared infrastructure itself) and of investments in customer relations should be avoided. Therefore, customer intelligence and service design should be kept separate and confidential.
- A prohibition to invest unilaterally in further (own-use) network coverage, or a prohibition or operational barriers to independent technology upgrades to the network blunts competition at the infrastructure level, because partners will not be able to differentiate themselves. Therefore, partners should be able to develop independent strategic plans and individually make further investments. This information should not be transmitted to partners.

3. Wholesale access to third parties should be guaranteed. Under active sharing, each partner should be allowed to offer wholesale access to the shared infrastructure, individually and independently.

The sharing agreement could effectively eliminate wholesale access by prohibiting it directly or by making access agreements very hard to reach. In order to avoid foreclosure, there should be a clear decision process for access requests, and the owner of the network should have the right to decide.

If the consent of both partners is necessary to provide access, as may be case in some forms of active sharing, the agreement could eliminate competition to individually provide access to third parties, facilitating foreclosure. In order to avoid this, such sharing agreements should be structured if possible in a way to make it possible for each partner to individually and independently provide access to its portion of the joint infrastructure as long as doing so does not adversely affect the quality of services available to the other partner.



4. Exclusivity provisions for entering the agreement should be kept to the minimum necessary.

The benefits from the agreement could leave other competitors at a disadvantage if access is unreasonably restricted. On the one hand, any investment in coverage or quality has this effect, so this is a normal feature of competitive dynamics. On the other, reducing the agreement's exclusivity provisions to the minimum necessary can help address this issue.

5. The agreement should protect the investor against opportunism from late co-investors.

The regulatory terms for mandatory co-investment can invite opportunistic behaviour by potential entrants, making it profitable for them to wait and then cherry-pick areas with high demand. This in turn makes first investment less attractive. To counter this undesirable effect, regulatory provisions should offer extra remuneration to the original investor(s) for late co-investment or change the timing of contracts and payments, for example using options contracts as discussed below.

6. To minimize the risk of coordinated behaviour, each partner should retain its independence, information exchange should be kept to the minimum necessary, and termination rules should be detailed and explicit.

As concerns coordinated effects, several aspects of agreements matter. First, it is essential that partners retain their strategic and commercial independence under the agreement, and their ability to differentiate their services, as already mentioned above. Second, transmission of commercial and strategic information facilitates collusion in the downstream market.

Therefore, no such information should be transmitted between partners, apart from that which is necessary to jointly plan network rollout. This is a particularly demanding exercise in the case of a joint venture (and subject to proper protocols), since information must be transmitted from all partners to the latter, which must then be unable to transmit it further. Third, in order to sustain tacit collusion, partners need to be able to "punish" each other in case of deviation from the collusive agreement, for example by abruptly terminating the agreement. In order to avoid this, the agreement should contain detailed rules for such a termination, including a time schedule that limits the potential damage to either partner.

05



OTHER IMPLEMENTATION ASPECTS

5. OTHER IMPLEMENTATION ASPECTS OF INFRASTRUCTURE SHARING

In this section, we discuss the following implementation aspects of infrastructure sharing agreements:

- When to regulate agreements, and when to leave them to the market;
- The interplay between infrastructure sharing and other regulatory provisions;
- Pricing of late co-investment;
- Infrastructure sharing with business users.

5.1. When to regulate, when to leave it to the market

Should infrastructure sharing be regulated (in some way) or should it be left to the market? This raises two different types of questions:

- Are such agreements likely to emerge without any regulatory intervention? If not, and if infrastructure sharing is deemed desirable, should regulators oblige firms to share their infrastructure?
- Whether infrastructure sharing emerges as a market outcome or is made mandatory by regulation, should the terms of these arrangements be regulated and, if so, how?

Market-driven emergence of infrastructure sharing

According to BEREC (2018), the "*motivation for [mobile] sharing is primarily market driven.*" Market-driven agreements are indeed common for mobile sharing. In some countries such as Portugal or Spain, commercial sharing deals for fixed (fibre) infrastructure have also emerged without any (visible) regulatory imposition.

However, Berkeley Research Group (2017) argues that in some cases, infrastructure sharing will not emerge as a market outcome, because the potential partners will lack the necessary incentives to engage in this kind of agreement. Berkeley Research Group (2017) cites different reasons:

- Asymmetries between potential partners, in terms of size, interests or strategic priorities, which make it difficult to reach an agreement satisfying all parties.
- Too many participants, which can also make it difficult to reach an agreement.
- Uncertainty about demand or costs, with the idea that infrastructure sharing is easier to implement in stable environments where market development can be easily predicted.

The literature on research joint ventures (RJVs) suggests a number of costs of establishing an RJV for firms (see Röller et al., 2007; Bourreau and Dogan, 2016), which can apply to infrastructure joint ventures too: transaction costs of forming the RJV, which tend to be higher when potential partners are asymmetric; coordination costs once the RJV has been formed, which are larger with a higher number of participants; costs in terms of reduced possibilities of service differentiation. The higher these costs, the less likely it is that a joint venture can emerge.

Therefore, in the context of infrastructure sharing, we can argue that an agreement will emerge as a market-driven outcome only if the expected benefits for the firms exceed the associated costs (e.g., transaction costs, coordination costs, etc.).

In their theoretical paper, Bourreau, Cambini and Hoernig (2018) discuss the likelihood that infrastructure sharing can emerge without any regulatory intervention and show that this is the



case if the benefits for the firms in terms of cost savings are larger than the costs, which correspond in their framework to lost profits due to increased competition. The idea is simple: infrastructure sharing allows partners to reduce their costs (e.g., fixed deployment costs and/or variable maintenance costs). But sharing also means that the partners will compete in the product market. If, in the absence of infrastructure sharing, only one firm could invest, it would bear all the costs, but also earn higher profits. In this case, infrastructure sharing is more likely to emerge if it reduces costs more than profits. If all firms would invest anyway (e.g., mobile operators in urban areas), then in this framework there are only benefits for firms of sharing (i.e., cost savings).

Firms' private incentives for infrastructure sharing do not necessarily coincide with the incentives for society. In particular, it may happen that a market-driven agreement will not emerge for the reasons discussed above, whereas it would be desirable from the point of view of society (e.g., simply because operators do not internalize the environmental benefits of sharing). In such a situation, mandating infrastructure sharing may be warranted, but the benefits from such an obligation should be balanced with the potential direct and indirect costs of it.

Regulation of infrastructure sharing agreements

The second question is whether the terms of infrastructure sharing arrangements should be regulated and, if so, how.

In Section 3, we discussed the possible anti-competitive effects of infrastructure sharing, in terms of unilateral and coordinated effects. To avoid these effects, some form of screening of infrastructure sharing agreements is desirable. It could take the form of *ex-ante* (approval) or *ex-post* (effects of the agreement) assessment of these agreements. A list of important design features of infrastructure sharing agreements to be scrutinized is provided in Section 4.3.

5.2. Interplay between infrastructure sharing and other regulatory provisions

Article 76 of the new European Economic Communications Code (EECC) states that operators with significant market power offering access to their infrastructure via co-investment can be exempted from other forms of access obligations.

In this section, we discuss the effect of having other regulatory provisions that apply in addition to co-investment and network sharing.

In their theoretical framework, Bourreau, Cambini and Hoernig (2018) analyse the effect of introducing an access obligation even when an operator deploying a network opens its infrastructure to potential co-investors. They show that combining access and co-investment has a priori pros and cons, even if there is only one potential entrant. On the one hand, adding an access obligation reduces the market power of the infrastructure owner in grey areas, where the entrant would not co-invest because it is too costly to do so. Therefore, in these areas, consumers benefit from a broader choice and lower prices. On the other hand, adding an access obligation lowers the profits that the incumbent can earn in the most outlying areas, where it is very costly to roll out a network, and thus, it reduces total coverage. Adding an access obligation also reduces the size of black areas with co-investment and service-based competition. These effects become stronger the more potential entrants would take up the access obligation.

The negative effect of adding an access obligation on top of co-investment comes in particular from the fact that the potential partner can choose to co-invest in low-cost areas, leaving the



incumbent investing alone in the costlier areas, while asking for access himself in the latter areas.

Thus, one can argue that adding regulatory provisions that are substitutes for co-investment, such as access obligations, promotes opportunistic behaviour from entrants, which reduces co-investment and ultimately harms investment incentives. In the context of the Code, this result suggests lifting regulatory obligations for SMP operators engaging in infrastructure sharing, at least for those obligations (such as access) which could spur opportunistic behaviour, makes thus sharing more effective.

By contrast, there may be regulatory provisions that complement co-investment, such as access to ducts and poles, which are likely to facilitate co-investment by making it less costly. Thus, such complementary provisions are likely to have the effect of stimulating co-investment and coverage. This suggests maintaining them, even when an SMP operator offers infrastructure sharing voluntarily.

The EU Directive on measures to reduce the cost of deploying high-speed electronic communications networks (2014/61/EU) aims to facilitate and incentivize network deployment by reducing its cost. It includes measures, such as the sharing and re-use of existing physical infrastructure. It can, therefore, be seen as a set of measures that are complementary to co-investment, which are beneficial in terms of co-investment and investment.

5.3. Pricing late co-investment

Rolling out communications networks of the next generation of technology, as is the case both with 5G and full fibre networks, involves a large to-be-sunk investment under an equally large degree of uncertainty about usage cases, future demand, and consumers' willingness to pay. Markets with such investments have been analysed extensively in the "real options" literature (see Dixit and Pindyck, 1994), which emphasizes that delayed investment is typical: Firms wait successively until more information becomes available. This timing issue becomes more pressing if investing firms are subject to access obligations, as has been typical in fixed electronic communications and been argued by Hausman (1997) and Pindyck (2007). Empirical studies have tended to confirm these concerns (see the surveys by Cambini and Jiang, 2009; Briglauer et al., 2015). Access obligations do not only reduce returns on investment, they provide potential entrants with the possibility to wait and cherry-pick markets that have proven to be profitable.

The same kind of concerns applies to mobile sharing and fibre co-investment when late participation is possible: Potential partners can delay participation and wait until they know which markets are the most profitable ones. This in turn can delay first investment, contrary to the policy objective of fast roll-out of high-speed infrastructure. Still, this seems less a problem for market-led agreements, where firms voluntarily join forces and agree on mutually beneficial terms to speed up and widen coverage. Here, the timing is driven by competitive forces. Rather, it is a concern that needs to be addressed whenever the possibility to enter into co-investment agreements is guaranteed by regulatory intervention because there are concerns about exclusionary conduct. Examples of these are the French regulatory framework for co-investment, where first investors are obliged to accept requests for later co-investment, and the provisions for co-investment in the EECC. In these cases, incentives need to be provided to both first investors and potential partners to not delay investment.

The economic literature has identified some classes of "risk sharing" measures than can alleviate this problem to some degree, see e.g. Inderst and Peitz (2014) for a high-level



discussion, or Bourreau et al. (2020) for a comparative evaluation using economic modelling. First, a partner that joins late should pay more for using the infrastructure, i.e., a “risk premium,” as proposed by Hausman (1997) for the case of access obligations. Second, potential co-investors could have to buy a “co-investment option”, i.e., the right to ask for co-investment later by making a payment when the first investment is made. Third, potential co-investors could enter a commitment to buy some minimum capacity once the infrastructure is rolled out.

Risk premia have been introduced in several countries for the determination of access prices. Usually, they are implemented through an increase in the WACC (weighted average cost of capital) used to compute a fair return on sunk assets. A similar implementation can be used for co-investment agreements, where future partners pay an additional value for using the infrastructure depending on how late they join (this would imply that risk premia first increase with time and later decrease, as depreciation starts to outweigh the costs of uncertainty). Such a path of risk premia provides future partners with an incentive to join early rather than later, and provides first investors with higher returns on their investment should co-investors appear later. A drawback of this approach is that the risk premium increases late co-investors’ operating costs and as a result reduces competitive intensity in the retail market. Thus, faster roll-out and higher coverage are “bought” at the price of a somewhat less competitive market outcome.

The alternative policy of selling a co-investment option does not suffer from this problem: Once the option is bought, its cost is sunk and no longer influences later entry and pricing decisions, and thus does not distort the market outcome. Furthermore, it provides the first investor with an immediate return on his investment, reducing investment risk. The difficult task in this scheme is to set the correct price for the option. First, it should depend on the expected cost of coverage, expected demand and expected number of co-investors, i.e., there is both natural and strategic uncertainty. Second, the option price cannot be too high, because otherwise the option will not be bought; and third, it cannot be too low because otherwise the additional incentives for first investment vanish. As shown in Bourreau et al. (2020), these conditions together imply that co-investment options are not feasible to cover the most costly and outlying areas: Since the resulting degree of retail competition is higher than under risk premia, joint profit no longer covers the high investment cost.

As just mentioned, setting a price for these options is not an easy task. If there are enough potential entrants, creating a market for such options may result in a meaningful price. An additional point is that a pure option scheme would restrict later co-investment to those entrants who bought the option beforehand. While it is precisely this fact that strengthens the incentives for early investment, it is inefficient after investment has actually been made, as pointed out by Carlton and Salop (1996), for example, in the context of research joint ventures. A market for options, as just mentioned, may also allay such concerns. In the absence of a market, either the regulator must make a credible commitment to not allow later entry, or complementary measures such as sufficiently high-risk premia must be imposed for entry without having bought an option at the outset.

Finally, the idea of potential co-investors providing a commitment to demand and pay for a minimum amount of capacity after the infrastructure is built at first seems similar to that of buying an option, as it reduces the first investor’s uncertainty about future returns. Still, the strategic implications are quite different: From a strategic and pricing point of view, the costs of any committed capacity are sunk and therefore the implicit marginal cost of using this capacity



is zero. This has the opposite effect of a risk premium, in that it intensifies competition in the retail market. While consumers should benefit in covered areas, this increased competition reduces the incentives for coverage in the first place. Note that this latter effect does not depend on which price was effectively set for the committed capacity.

This short description of some measures to counter the perverse incentive effects of allowing late co-investments shows that the details for regulatory design can matter a great deal, and that a trade-off between long-run (investment) and short-run (competition) goals is unavoidable. Which measures are most promising depends on geographic features (how costly is it to cover the most outlying areas?) and the dynamics of market structure (how many potential partners?).

5.4. Infrastructure sharing with business users

With the advent of 5G technology, new connectivity solutions for industrial users are being imagined, providing real-time information transmission and control, seamless coverage, and tight security. Several deployment models are being considered, with various levels of build and ownership by either mobile networks or industrial users themselves. Larger companies are more prone to create their own network (Detecon 2019), and equipment providers such as Ericsson already offer solutions for such private networks.¹⁸ These networks need a local spectrum license, and some have already been built (Arthur D. Little, 2019).

Most industrial users, though, do not have the expertise to build and run their own networks and prefer a partnership with a mobile operator. These partnerships can have a variety of forms. At the most separated level, the mobile operator runs a private network for the company, with the possibility to interconnect (for security reasons possibly only for outgoing communications) with the public network. A less extreme solution is dual slicing of the mobile operator's network, where a "slice" of the latter's spectrum is reserved exclusively for the industrial user and a logically independent virtual network is configured for him.

An alternative for business users, in industries such as automobile or health, would be to engage in broader cooperative agreements with public and private partners. For example, in the context of the European 5G PPP project,¹⁹ various experiments are under way involving public and private actors, in particular in Italy (partnership between the city of Torino, TIM, Ericsson and other players) and Spain (partnership between the city of Malaga, Telefonica, Nokia and others).

These few points are just the tip of the iceberg of potential provider-user configurations, and we have not yet even mentioned the design and provision of specific services to be run over these networks. Over time, as both technology and business cases develop, and more pilot projects appear, a clearer picture will likely emerge. For now, some countries such as Sweden and Germany are reserving some spectrum bands for industrial networks, but otherwise developments are left to the market.

The regulatory aspects of infrastructure cooperation with MNOs, third or neutral parties, and public-private partnerships, should be subjected to further study.

¹⁸ See <https://www.ericsson.com/en/networks/offerings/mission-critical-private-networks/private-networks>.

¹⁹ See http://ec.europa.eu/research/press/2013/pdf/ppp/5g_factsheet.pdf.

06

CASE STUDIES

BELGIUM, DENMARK, FRANCE, GERMANY,
IRELAND, ITALY, NETHERLANDS, PORTUGAL,
SPAIN, SWEDEN, SWITZERLAND, UK

6. COUNTRY CASE STUDIES

6.1 General lessons from country case studies

Mobile sharing

The sharing of passive mobile infrastructure such as sites and masts has a long tradition and is widespread. In some countries it is even mandated to various degrees (Belgium, France, Netherlands, Spain, and potentially in the rural areas of the UK). Its benefits in terms of lower costs of coverage and operation, lower environmental impact, and higher coverage, are clear, and at the same time few competitive concerns have arisen.

Still, operators in an increasing number of countries are opting for active RAN sharing agreements, usually in the transition to the next generation of technology, such as 4G and now 5G. According to BEREC (2018), most agreements were based on commercial negotiations and are not the result of regulation. Sometimes these agreements are openly encouraged by national regulators, such as in Italy or Portugal, but in most cases are subject to vetting by competition authorities. In many cases these mandate changes to the original agreements in terms of exclusivity, coverage, timing, and information sharing. In 2008, Lithuania imposed active sharing of 3G networks on rural areas, but this kind of active sharing obligation is an exception.

Furthermore, in most countries, deeper types of sharing, such as core network and/or spectrum sharing, are not permitted. Only four European countries have MOCN sharing: Denmark, Finland,²⁰ Poland, and Sweden (see below). In 2018, these were part of the five countries with full LTE coverage.

The evidence publicly available so far indicates that mobile network sharing of all degrees has helped increase coverage and diffusion of new technologies and that even high degrees of sharing, subject to some constraints imposed by competition authorities, have not dented competition in the retail market for mobile services.

Fibre co-investment

Co-investment agreements for fibre roll-out are a more recent phenomenon. There are two starkly different approaches. France opted for a complex regulatory framework mandating that first investors accept co-investing entrants. The exact types of obligations differ between urban, suburban and rural regions. The uptake of these schemes has been rather low. Other countries prefer voluntary agreements between operators, and a wide range of successful commercial agreements now exists (plus some agreements that were terminated early).

Finally, the EECC, which entered into force in December 2018, includes provisions that link openness to co-investment to the removal of regulatory obligations on operators with significant market power. These provisions are presently being transposed into national law, and it is too early to evaluate their effectiveness in terms of implementation and fibre coverage.

As concerns outcomes in terms of coverage, it is difficult at this point in time to establish a causal link between co-investment regulation or voluntary agreements and fibre coverage. If any, a causal relation seems to go from lack of coverage to more rules and agreements, rather than from more agreements to higher national coverage. The reason for this is that in countries

²⁰ The Finnish mobile network sharing agreement between Telia and DNA is a MOCN sharing agreement covering 50% of territory and 15% of population (see: <http://yhteisverkko.fi/en/>).



where coverage expanded rapidly, for example because of duct and pole-sharing obligations and little else in terms of regulatory intervention, such as in Portugal and Spain, these agreements were largely not deemed necessary and appeared voluntarily. On the other hand, countries such as France, which perceived a future potential lack of coverage, took the initiative to create such agreements. Thus, a reasonable evaluation of the effectiveness of measures to encourage co-investment would not be a comparison of absolute levels of coverage between countries, but a comparison of the change in the extent of coverage of different types of areas that occurred before and after the implementation of co-investment agreements (or in their absence).

6.2. General lessons from case law

The individual competition cases are discussed in the country cases below. The key lessons from case law can be summarized as follows:

Mobile sharing

Sharing of passive network infrastructure (masts, ducts, power supply) is not generally found to restrict competition. However, competition authorities will verify whether the cooperation may reduce the total number of sites available to third party operators. This reduction may result from a reduction in the total number of sites, such as where the cooperating operators decommission some of their existing sites as a result of the cooperation. The reduction may also result from less space on the parties' sites, due to the space being reserved for the other partner. The reduction may also result from the parties setting unfavourable commercial access conditions.

Sharing of active radio access network elements raises concerns on the parties' incentives and ability to compete aggressively on product differentiation and network quality, including each party's incentives to invest in network upgrades for 4G and 5G. The key question is whether each party will invest in capacity upgrades at least to the same extent as they would have in the absence of the cooperation.

The geographic scope of the sharing will be a key consideration, as will be the number and market power of other operators on the market. If sharing is limited to less densely populated areas, and competition is intense in densely populated areas, sharing can be accepted on the theory that the parties' incentives to independently invest in network upgrades will be maintained thanks to the competitive pressures existing in the densely-populated areas. Where investment incentives are not aligned, competition authorities will focus on risks of potential hold-up by one party of the other's network upgrade plans. Where sharing involves spectrum, competition authorities will focus on the possibility of the parties obtaining being able to obtain too much spectrum compared to others.

Competition authorities will also ask whether the cooperation will negatively impact other existing sharing or MVNO agreements that either of the parties may have entered into before the cooperation. Competition authorities will ask whether the new cooperation changes the incentives of one of the parties vis à vis its other contractual partners, thereby leading to quality problems or investment barriers adversely impacting the other contractual partners.

National roaming is generally found to restrict competition, but can be exempted temporarily to permit a new entrant to introduce new services on a national basis. The exemption will be limited in time and geographic scope (dense v. less dense areas). As is the case for active sharing, the exemption will depend on market shares and number of MNOs in the market.



Information exchange will be scrutinized to ensure that it is limited to the strict minimum necessary for technical sharing. Active sharing may require communication of sensitive information such as traffic forecasts, which increases the risk of anticompetitive coordination.

Fibre co-investment

Extent of fibre roll-out will be one of the chief concerns of competition authorities. Is cooperation likely to result in more and faster network roll-out than the counterfactual? Based on this test, co-investment is not likely to be accepted in areas where the parties would invest anyway in a race to be the first to deploy fibre. Are the roll-out commitments made by the parties credible and enforceable? Where one of the party's interests do not appear to be aligned, which might be the case in an area where one of the parties also controls a cable network for example, there may be a risk of delay or hold-up despite what is written in the contract. Competition authorities will also focus on strictly limiting the geographic scope of cooperation, to avoid spill-over into other areas where parties are expected to compete on fibre deployment, including in calls for tender for publicly-funded fibre projects.

Market entry by third party operators will be a key focus of competition authorities, including availability, pricing, and SLAs for wholesale fibre access products (VULA, NGA bitstream), as well as IRUs for a portion of the fibres deployed by the parties to the co-investment. The parties to the co-investment may be required to ensure that some fibres are set aside for third party operators. Parties may be subject to a non-discrimination obligation vis à vis third party operators.

Non cost-based pricing of wholesale inputs may lead to alignment of retail prices if margins are baked into the pricing of wholesale inputs such as ducts, fibre, and maintenance services. Non cost-based pricing of upstream wholesale inputs may also raise prices for third party operators seeking fibre or other wholesale products offered by the JV or its partners on the downstream market.

Information exchange will be scrutinized to ensure that it is limited to the strict minimum.

6.3 Belgium²¹

By mid-2018, NGA (VDSL, FTTP and DOCSIS 3.0) coverage was above 99% (but only 1.4% FTTP), with rural coverage above 90%. National cable coverage was above 95%. However, FTTH/P coverage is low, with 1.4% covered in 2018 according to the European Commission's Digital Scoreboard. Belgium has complete LTE coverage.

Mobile sector

The Electronic Communications Act makes passive sharing of sites and masts mandatory. In case of disputes between operators, the national regulator BIPT can also impose cost sharing. National roaming for new 2G entrants was imposed.

According to the BIPT guidelines of 2012, core network sharing (GWCN) is not allowed, spectrum sharing (MOCN) is discouraged, while RAN sharing (MORAN) is allowed if the partners remain technically and commercially independent and passive sharing is encouraged (the government actually made the latter mandatory). The guidelines do not indicate geographic restrictions for sharing agreements, but prohibit the division of coverage into separate areas serviced by different operators. Proposed agreements on RAN sharing must be presented to BIPT.

A joint venture for RAN sharing (MORAN), with the objective of jointly investing in mobile network infrastructure, was proposed between Proximus and Orange in 2019. The agreement is currently (March 2020) under investigation by the national competition authority after a complaint by competitor Telenet.

Fixed sector

As concerns the fixed network, the incumbent Belgacom's (now Proximus) focus was to achieve full VDSL coverage, while the regulator imposed SMP access (but no duct access) regulation on both copper and cable. Together with high cable coverage, this implied that there was, at least until 2018, very little investment in fibre, both by the incumbent Belgacom (now Proximus) and potential entrants. For the same reason, no co-investment agreements were made. Thus, while NGA (VDSL and cable) coverage is high, there was until recently little pressure to upgrade to FTTH, nor potential entrants who might have taken part.

Lessons: The mobile market is well-developed, with full coverage in LTE technology. Still, the transition to 5G presents new challenges, which made two of the three MNOs join forces in a RAN sharing agreement.

²¹ This case study on Belgium relies on the following sources: EC (2018), Cullen (2019b), European Commission (2019), Ovum (2019), WIK (2016).

6.4 Denmark²²

Denmark is one of only few cases in Europe (the others include, e.g., Poland and Sweden) where two mobile operators share both the physical network infrastructure and radio spectrum. It had 4 mobile operators since 2003, thus the sharing agreement still left 3 independent networks. Sharing agreements remain subject to competition law. Passive sharing of sites and masts has been mandated since 2004.

In June 2011, Telenor and Telia agreed to share a single mobile network, including radio spectrum. For this purpose, in February 2012 they created the infrastructure joint venture TT-Netværket. Radio frequencies (1800MHz, 2600 MHz range) were transferred to TT, and in June 2012 TT itself even obtained more (2x10MHz in the 800 MHz band, for 4G services) for about \$16m. By August 2015, the shared network for 2G/3G/4G was completed. In August 2017, Nokia, who was the supplier for the shared network, took over its planning and operation. In March 2019, TT won additional spectrum in the auction in the 700/900MHz bands, with a coverage obligation of down/uplink speeds of 30Mbps/3Mbps in 66 underserved areas (though Hi3G and TDC received much bigger allocations). The 900MHz range was freed in December 2019 after 2G licenses ran out.

The sharing agreement was examined in 2012 by the Danish Competition Council, which found 6 competition problems under Article 101(1) TFEU (see the box below). Five of these concerns were addressed with remedies (wholesale access to avoid foreclosure; an internal tariff structure to avoid the transformation of fixed into variable costs, reducing upward pressure on retail prices; an obligation to buy spectrum jointly in order to avoid excessive accumulation of spectrum; sale or leave of unused sites; and restrictions on the joint venture to avoid the transmission of information). For the sixth concern, about the reduced incentive to compete in coverage and technology, the DCC found that the conditions for an exemption under Article 101(3) were fulfilled. In 2015, the two partners proposed to merge, but desisted in the face of the conditions imposed by the European Commission. BEREC (2018) states that the sharing agreement seems to work fine, even though the two partners are in "fierce competition".

As concerns fixed broadband, the implementation of the BCRD of 2014 put into place rules on sharing passive infrastructure and in-building access. However, we could not find any evidence of co-investment agreements in Denmark.

Lessons: The case of Denmark shows that even wide-ranging sharing agreements in the mobile sector, including the sharing of the whole network and spectrum, need not be an obstacle to strong competition in the market. But it is necessary to have enough competitors and to make sure that the agreement does not contain clauses that restrict competition.

²² This case study on Denmark relies on the following sources: BEREC (2018), in particular Annex 1 p.23; Mobilsiden.dk, "Nokia overtager driften og udviklingen af TT-netværket", 22 August 2017, <https://www.mobilsiden.dk/nyheder/nokia-overtager-driften-og-udviklingen-af-tt-netvaerket,lid.38593/>; Telenor Group, "Telenor obtains new 4G licence", 27 June 2012, <https://www.telenor.com/media/press-release/telenor-obtains-new-4g-licence/>; TeleGeography, "TT-Netværket, Nokia complete 2G/3G/4G network sharing project", 23 August 2015, <https://www.commsupdate.com/articles/2015/08/13/tt-netvaerket-nokia-complete-2g3g4g-network-sharing-project/>; TeleGeography, "Hi3G, TDC, TT-Netværket winners in spectrum auction", 29 March 2019, <https://www.commsupdate.com/articles/2019/03/29/hi3g-tdc-tt-netvaerket-winners-in-spectrum-auction/>

DENMARK - Telia Denmark - Telenor site sharing (2012)

Danish Competition Council decision of **29 February 2012** on mobile network sharing between Telia Denmark and Telenor.

Form of cooperation: Creation of Newco to own, control and develop RAN infrastructure: masts, antennas and frequencies, including 2G, 3G and LTE, with coverage over entire territory.

Comments of the competition authority:

No sharing of core networks, so operational autonomy and remain separate mobile operators. Telia and Telenor are numbers 2 and 3 on the retail market. Objective is to create a network that can challenge TDC, the leading MNO in the market.

Concerns relate to access by competing operators to sites and wholesale services, accumulation of frequency, reduction in total number of sites available to third parties, information sharing.

Commitments:

- Risk of collusion on wholesale market; Commitment: parties agree to accept all wholesale requests.
- Tariff structure of Newco changes fixed costs to variable costs, thereby dampening parties' incentive to compete. Commitment: Newco to charge parties cost-oriented prices for RAN services
- Possibility in the future of the parties obtaining more frequencies than other operators; Commitment: Future spectrum purchases must be through the JV company.
- Reduction in total number of sites means competing operators who rent space may have coverage problems. Commitment: parties will sell or lease any superfluous sites to third parties who request.
- Information sharing goes beyond what's necessary; Commitment: functional separation and Chinese walls to limit exchange of information.
- Identical coverage, deployment, so dampens competition. No commitment, but exempted based on fact that efficiency gains outweigh harms to competition.

6.5 France²³

Fixed sector

In France, co-investment is implemented as an alternative to standard regulated access. Thus, co-investment is mandatory for all operators investing in FTTH networks, and the conditions are specified by the regulator ARCEP, as we detail below.

The regulatory framework splits France into two types of areas: the *very dense areas* ("zones très denses"), which correspond to about 6.4 million households, and the other areas, called the *less dense areas* ("zones moins denses"), with the remaining 29.9 million households.

Very dense areas were defined by ARCEP as a list of municipalities. These municipalities are defined as locations where infrastructure-based competition between FTTH operators is deemed achievable, according to an (unpublished) analysis made by ARCEP. In its 2009 decision (Decision n° 2009-1106, 22 December 2009), ARCEP considered that very dense areas consisted in a list of 148 municipalities, representing a total of 6 million households. ARCEP revised this list a few years later in its 2013 decision (Decision n° 2013-1475, 10 December 2013), reducing the number of municipalities to 106, representing 5.5 million households overall. Between its 2009 and 2013 decisions, ARCEP removed 43 cities from the initial list, due to the absence of any observed development of infrastructure-based competition in them, and added one city that was not part of the first list, because infrastructure-based competition had emerged in it.

The less dense areas are then simply defined as France less the very dense areas.

Different rules for co-investment, defined by ARCEP, apply to very dense and less dense areas.

Rules in very dense areas

The rules applied to the very dense areas are defined in ARCEP's Decision 2009-1106. Since infrastructure-based competition is deemed feasible, a light-handed regulatory approach is adopted, where only the in-building wiring is shared between operators. Thus, any operator building a FTTH network in very dense areas is mandated to provide access to other interested operators for the in-building wiring at the base of the building. Early co-investors share the investment costs for in-house fibre. Late co-investors have to pay a risk premium.²⁴

Rules in less dense areas

For the rest of the country, that is, in the so-called "less dense" areas, the French government launched a call for expressions of interest in FTTH investment ("Appel à Manifestation d'Intérêt à Investir") in January 2011 (Decision 2010-1312 of December 14, 2010). Operators were invited to declare in which municipalities within the less dense areas they were interested to invest in the next five years. Municipalities with the interest of at least one private operator are called "AMII" areas. They represent about 13.1 million households, according to ARCEP. In the rest of the country (16.8 million households), investment is supposed to take place through public intervention. Orange and SFR were the only two operators to make a significant commitment to cover AMII areas.

Various co-financing agreements were then signed between Orange, SFR and other operators. A co-investment agreement was signed in 2011 between Orange and SFR in the form of a

²³ This case study of France relies in particular on the following sources: ARCEP (2016), BEREC (2018), Berkeley Research Group (2017), Cullen (2019a), Cullen (2019b).

²⁴ There is further distinction between buildings with more than 12 apartments and other buildings, and the framework also makes an exception for low-density zones in very dense areas.



reciprocal access deal (but within France's framework, which corresponds rather to one-way sharing) for 9.8 million households (7.5 million covered by Orange, 2.3 million by SFR). Orange and SFR updated this agreement in 2018, with the objective of covering 13.7 million households (11.1 million by Orange, 2.6 million by SFR). Co-investment agreements were also signed between Orange and Free and Orange and Bouygues, with Orange as the leading operator. In 2010, SFR and Bouygues Telecom signed a co-investment agreement ("Faber" contract), with SFR as the leading operator. This agreement was disrupted by the acquisition of SFR by Altice/Numéricable (the cable operator) in 2014, but the competition authority asked for a commitment that SFR would continue to honour its fibre co-investment agreement. In March 2017, the competition authority fined Altice/SFR for failure to respect this commitment (see box below).

The rules for less dense areas are defined in ARCEP's Decision 2010-1312.

In these areas, an operator covering a zone is mandated to provide access to its infrastructure at concentration points aggregating 1,000 lines or more through long-term contracts (Indivisible Rights of Use, IRUs) for 5% increments of lines. Access seekers can decide to co-invest *ex-ante* by co-financing the infrastructure (in terms of IRU), to co-invest *ex-post*, in which case they must pay a premium in addition to the co-financing fee, or to rent infrastructure lines on a short-term basis.²⁵ The access price should be fair, reasonable, and non-discriminatory. In essence, early co-investors a share of the relevant investment costs, and late co-investors should pay in addition a premium to compensate the early investors for the risk taken. ARCEP developed a cost model in 2014 to calculate the cost co-investing operators were allowed to charge.

Note that ARCEP has also implemented (asymmetric) regulations for access to ducts and poles of the historical operator Orange in a 2008 decision (Decision n° 2008-0835, July 2008) and a 2010 decision (Decision n°2010-1211, November 2010). These decisions were recently revised with decisions n°2017-1347 on the definition of market 3a and n°2017-1488 on the methodology of access pricing to ducts and poles.

In January 2020, the competition authority received a request from regional telecom operators for a national activated FTTH wholesale offer. The competition authority denied the request, holding that a national activated FTTH wholesale offer is not an essential facility, given the presence of other alternative (see box below).

In terms of outcome, France lies at the average in the European Union, with 38% of households covered with FTTH as of 2018, according to the European Commission's Digital Scoreboard. However, France has the lowest coverage for NGA, at 58%, due to the limited coverage of cable and the choice to favour FTTH deployment over VDSL.

Mobile sector

In France, spectrum licenses include obligations to provide roaming to other operators under specific circumstances. Operators are also required by the Code of Telecommunications to ask other operators for their interest in network sharing when deploying new sites outside of dense areas. This is required by law for 3G, and is part of license obligations for 4G.

Different sharing agreements in France for mobile networks have been signed between mobile network operators.

²⁵ It is also possible to purchase some increments *ex-ante* and others *ex-post*.



In 2012, a national roaming agreement for 2G and 3G was signed between Orange and the new entrant Free mobile. The 2G roaming agreement was the consequence of a regulatory obligation, but the roaming agreement for 3G was a commercial deal.

In 2016, ARCEP published guidelines on mobile network sharing. In this document, ARCEP encourages sharing of passive infrastructure all over the territory. However, it states that active (RAN and/or spectrum) sharing is not desirable in dense areas, where infrastructure-based competition is likely to develop and provide its benefits, and should be assessed on case-by-case basis in less dense areas. Finally, existing roaming agreements should be progressively phased out, with a termination date at the end of 2022 at the latest.

After the publication of ARCEP's guidelines, Free mobile and Orange declared that they would end their roaming agreement in 2020. However, they recently announced, in April 2020, their intention to prolong their national 2G/3G roaming deal until end of 2022.

Another roaming agreement exists between SFR and Bouygues Telecom for active sharing of their 2G, 3G and 4G RAN infrastructure on 85% of the territory, corresponding to 57% of population (the "Crozon" agreement, signed in 2014). According to this deal, each operator offers access to its RAN infrastructure in its areas, and a joint venture is formed to manage shared sites and shared RAN.

4G coverage is full (at 99% in 2018). ARCEP argues that network sharing allowed expanding and accelerating coverage. However, in its 2016 guidelines, it raises the concern that it can harm investment and innovation.

Lessons: In France, a highly regulated and detailed framework has been put in place for the deployment of fibre. However, ten years after the implementation of this framework, the outcome is mixed. While growing, FTTH coverage is still just average in the European Union, and infrastructure-based competition has emerged only in large urban areas. The Altice-Bouygues Telecom's case shows the difficulty to align interests between the partners of an infrastructure agreement, in particular for the long period of time necessary to deploy network infrastructure.

In the mobile sector, network sharing has allowed operators to cover the most outlying areas in France, which probably would not have otherwise been covered (or as early).

FRANCE - Orange fibre not an essential facility (2020)

Competition authority decision of **23 January 2020** on alleged abuse of dominance by Orange in connection with access to fibre.

Form of cooperation: N/A

Comments of the competition authority:

An association of regional telecom operators asked for provisional remedies to require access to a national activated FTTH wholesale offer, on the grounds that it is an essential facility. The competition authority denied the request for provisional remedies, holding that a national activated FTTH wholesale offer is not an essential facility, given the presence of other alternative offers (including regulated wholesale access to Orange ducts and certain fibre) available which would permit a new entrant to replicate Orange's FTTH infrastructure.

FRANCE - Altice/SFR sanctioned for failure to honour fibre co-investment agreement with Bouygues Telecom (2017)

Competition authority decision of **8 March 2017** sanctioning Altice/SFR €40 million for failure to respect commitments to honour a 2010 fibre co-investment agreement ("Faber" contract) with Bouygues Telecom.

Form of cooperation: a 2010 fibre co-investment agreement whose equilibrium was disrupted by acquisition of SFR by Altice/Numéricable.

Comments of the competition authority:

The competition authority approved Altice/Numéricable's acquisition of SFR, but required commitments to ensure that after the acquisition, SFR would continue to honour its fibre co-investment agreement with Bouygues Telecom dated 9 November 2010. After the acquisition, SFR would lose its incentive to roll out FTTH because SFR's FTTH networks are located in the same zones as Altice/Numericable's cable/fibre networks.

The competition authority therefore identified a risk that in spite of contractual guarantees, SFR in fact would not perform its obligations under the Faber agreement. Under the Faber agreement, Bouygues Telecom co-invested 50% of costs, but the deployment is done by SFR on behalf of both parties.

Because economic interests were originally aligned, the original Faber agreement did not have strict penalties or milestones for SFR's work. Hence the competition authority's insistence on specific commitments, including a firm commitment to build out to mutualisation points already delivered by building operators, as well as future mutualisation points requested by Bouygues Telecom. SFR also agreed to specific service level agreement for maintenance, with KPIs. SFR claims that the failure to respect these conditions is due to operational constraints, but the competition authority found these defences unconvincing, and imposed a €40 million fine.

FRANCE – Competition Authority guidance on mobile network sharing (2013)

Competition Authority opinion n° 13-A-08 of **11 March 2013** on mobile network sharing and roaming agreements.

At the request of the Ministry of Economy, the French Competition Authority issued guidelines on the compatibility of mobile network sharing and roaming agreements with competition law. The first section of the guidelines summarize the key provisions of the Commission Guidelines on horizontal cooperation agreements, and in particular the provisions on production agreements that we summarized above in Section 2.2.

The Competition Authority emphasizes that the market shares of the parties will be a key consideration, both on the wholesale market and on the retail market. Next, the geographic scope of the cooperation will be a key factor, the narrower the geographic scope the lesser the likely impact on competition. The third key factor will be the level of decisional autonomy. The Competition Authority compares three sharing scenarios. The first, sharing of passive infrastructure, will permit the highest level of autonomy of each of the parties in their investment decisions as well as the lowest level of cost coordination. RAN sharing in theory allows each partner to upgrade its own portion of the network independently, by increasing capacity and/or changing standards independently of the other party. In practice, however, RAN sharing can limit each party's autonomy much more than passive sharing, so must be evaluated carefully on a case by case basis. Frequency sharing results in total loss of autonomy of each of the parties because investment decisions must be made together, and upgrades affect both parties.

For RAN sharing the parties may need to communicate forecasted traffic volumes to each other, which increases the risk of anticompetitive coordination. RAN sharing also leads to more uniformity in variable costs, contributing to the risk of uniform pricing.

The form of network sharing and its effect on competition will depend on the geographic area. In rural areas, RAN sharing will pose little risk for competition. Frequency sharing may also be possible in some cases, subject to regulatory scrutiny. In dense areas, sharing passive elements will be fine, and may even be required by city planning rules. However, RAN sharing will be problematic, and frequency sharing out of the question. In semi-dense areas, RAN sharing may be permitted.

As regards roaming, the Competition Authority confirms that roaming can be a temporary solution to help a new entrant penetrate the market, and may also be a solution to provide network redundancy. But roaming must be limited in time and should not generally be permitted in dense areas where the operator is expected to deploy its own infrastructure in priority.

6.6 Germany²⁶

Germany encouraged site sharing early, first for environmental reasons. After Deutsche Telekom was privatized in 1996, in 2002 it transferred the sites to a new 100%-owned company, Deutsche Funkturm GmbH, which continues to serve both Deutsche Telekom and competitors.

Further rules on network sharing were defined in 2000 in the context of the UMTS auction, and clarified in the 2001 "Thesenpapier": Passive and active sharing were allowed, as long as networks remained independent in functional and competition terms. In particular, a division of the national territory and the sharing of core network and spectrum were ruled out.

Based on these rules, in September 2001, T-Mobile Deutschland GmbH and O2 (previously called VIAG Interkom GmbH) reached an agreement for 3G on reciprocal extended site sharing, with each constructing its own network and providing reciprocal roaming to each other outside each operator's 50% coverage area. The agreement also included national roaming for O2 (following a previous such agreement from 1999 on 2G) in an area sufficient to reach a 50% coverage target in 2005 (ended in 2009 after O2 completed its network). No part of the agreement was exclusive. The European Commission analysed the agreement (European Commission 2003) and concluded that some aspects were likely to restrict competition, in particular in the wholesale market (see box). It therefore negotiated staggered temporal restrictions on roaming, ending first in urban areas, etc. In 2006, the European Court of First Instance revoked the time limits on roaming based on the argument that the agreement strengthened the competitive position of O2 and therefore instead of restricting competition might actually have been capable of increasing it (see box).

The rules for sharing were relaxed in 2009 with the attribution of the 800MHz range, with sharing encouraged to meet a *joint* coverage obligation. In 2010, the national regulator BNetzA published a new set of guidelines ("Eckpunktepapier"), maintaining that passive sharing and certain types of RAN sharing were allowed without previous regulatory approval if competitive independence and infrastructure competition were guaranteed. Farther-reaching proposals for sharing, including spectrum sharing in coverage gaps, could be presented for individual analysis. Operators did not take up these propositions, though, following separate commercial strategies.

A further auction of 700MHz spectrum confirmed earlier rules, but introduced individual coverage obligations.²⁷

In June 2018, German average LTE coverage remained below the EU average of 94.3%.²⁸

In 2009 Vodafone and Telefonica made a pan-European passive site sharing agreement in Germany, Ireland and Spain. In November 2019, Deutsche Telekom, Vodafone and Telefonica responded to the coverage obligations on the 2019 auction by announcing an agreement (to which also the new fourth operator 1&1 was invited) to build 6,000 new shared sites, accompanying traffic routes.

²⁶ This case study on Germany relies on the following sources: Berkeley Research Group (2017), Cullen (2019a), Cullen (2019b), European Commission (2019), OECD (2014), European Commission (2003); WIK (2016), Network Sharing im Mobilfunk und Festnetz-Mobilfunk-Konvergenz in der Schweiz, pp.66-73, 95-97; Deutsche Telekom, <https://www.telekom.com/en/media/media-information/archive/cooperation-network-expansion-telefonica-deutschland-544482>; Deutsche Telekom, March 2019, Deutsche Telekom and EWE sign contract for joint venture "Glasfaser NordWest", <https://www.telekom.com/en/media/media-information/archive/deutsche-telekom-and-ewe-sign-contract-for-joint-venture-566330> Deutsche Telekom,

²⁷ WIK, 2016, p. 73.

²⁸ European Commission, 2019, p. 33.



Co-investment: In 2012, Deutsche Telekom proposed long-run contracts of 8 plus 3 years for bitstream capacity, subject to an initial fee and a lower monthly fee. The BNetzA considered that such contracts would reduce incentives for alternative investments and also create a margin squeeze for third-party operators. It therefore imposed that contracts could be terminated every two years and raised the monthly fee (We have not been able to confirm whether these were taken up).

Also in 2012, Deutsche Telekom and the local fibre operator Netcologne in Cologne agreed to give access to each other in their areas of VDSL and fibre coverage, respectively. In 2013, Telefonica and Deutsche Telekom reached a co-financing agreement for migrating Telefonica's LLU customers to bitstream access over FTTC and vectoring, while Deutsche Telekom upgraded at least 65% of its network accordingly. Further agreements were made between Deutsche Telekom and local operators under the so-called "contingent price model", where the latter make an up-front payment for a certain number of access lines and can later use them at a reduced fee.

The DigiNetz act of 2016 brings additional actors into fibre deployment. Traffic construction projects supported by public funds and existing utility infrastructures in the electricity, water, gas, road and railway sectors must support fibre deployment. Local governments are responsible for equipping new residential areas with a passive fibre network.

In October 2018, Deutsche Telekom and Telefonica agreed to connect 500 mobile base stations of the latter to DT's fibre network, continuing their backhaul collaboration dating back to 2011. In March 2019, Deutsche Telekom and the energy provider EWE in Oldenburg announced the creation of the joint venture "Glasfaser NordWest", to connect 1.5 million households and firms to fibre in Northern Germany, at the expense of 2bn Euros over 10 years. Rural areas will be covered, and access will be offered to competitors, including the possibility of co-investment. The agreement was presented to and approved by the Bundeskartellamt in January 2020, subject to some clarifications and commitments concerning regional competition (see box).

Lessons: There are some lessons from the German experience: First, joint coverage obligations on all market players with an invitation to share resources will fail if operators' interests diverge too much. It seems more likely that bilateral rather than market-wide ones can be done.

Second, though national roaming is usually limited in time because it is understood to restrict competition, persisting asymmetries can imply that maintaining it may increase the competitiveness of smaller players. Thus, even the evaluation of roaming agreements needs to take into account the exact national circumstances.

GERMANY - DTAG - EWE fibre deployment (2019)

Bundeskartellamt decision of **5 December 2019** on binding commitments undertaken by Telekom Deutschland GmbH and EWE AG relating to their cooperation in fibre optic deployment in Lower Saxony, North Rhine-Westphalia and Bremen.

Form of cooperation: creation of a JV company, reviewed under both cooperation rules and under merger control.

Comments of the Bundeskartellamt:

For fibre deployment, competitive dynamics include the race to be the first to deploy. Cooperation between the major competitors in the region would dampen this incentive. The two companies, each of which has a strong market position in the area, would have fewer incentives to make the high investments.

The deployment commitment mitigates this concern: **“the network in the area concerned will be expanded to a greater extent than was originally planned as part of the cooperation and then could be expected if the companies were to carry out the development independently of one another.”**

The Bundeskartellamt was also concerned that the parties would focus predominantly in areas covered by cable networks, which are the principal competitors to fibre.

Finally, the Bundeskartellamt was concerned that the joint venture would take measures to hinder entry by third party operators.

Commitments:

- to upgrade to fibre 300,000 connections in the region within 4 years, including in rural areas, under commercial terms (i.e. without subsidies). Rationale: the roll-out under the commitment is higher than that originally planned, and more than what could be expected if the companies were to deploy independently.
- each party will participate separately in public tenders for rural deployment;
- the parties will refrain from any “specific strategic defence measures” vis à vis third party operators; and parties will not focus only on urban areas with cable already;
- third companies will be granted non-discriminatory access to the new network and to high-quality technical upstream services. After a specific period, a certain share of the expanded connections will be handed over to competing telecommunications companies to compete.

GERMANY - T-Mobile - O2 site sharing and national roaming (2003)

European Commission decision of **16 July 2003** relating to network sharing between T-Mobile and O2 Germany.

Form of cooperation: contractual (no JV company).

Comments of the Commission:

Parties maintain separate core networks, and will not share frequencies. The agreement is not exclusive: each party can agree on extended site sharing, RAN sharing and national roaming with third parties. The agreement contains safeguards in relation to the exchange of confidential information - only information necessary for the technical realisation of site sharing can be exchanged.

Site sharing does not result in similarity in the Parties' cost structure that could affect their ability to compete effectively with each other in downstream network or services markets.

Re site sharing: "The parties retain independent control over their core networks including all intelligent parts of the network and the services platforms that determine the nature and the range of services provided. The parties also retain independent control over their radio planning and the freedom to add sites, including non-shared sites, in order to increase their network coverage and capacity, which appear to be the main competitive parameters at network level, and which are likely to have an important impact on the level of services competition. Because site sharing will reduce search costs and will eventually allow greater network density it can improve network competition, and thereby services competition, both between the Parties and with third parties." (para. 102)

Re national roaming: National roaming..."by definition restricts competition between these operators in all related network markets on key parameters such as coverage, quality and transmission rates. It restricts competition on scope and on speed of coverage because instead of rolling out its own network to obtain the maximum degree of coverage of territory and population within the shortest period of time, a roaming operator will rely for its roamed traffic on the degree of coverage achieved by the network of the visited operator" (para. 107)

The effects will be more serious in areas where there is a clear economic case for the roll-out of parallel competitive networks. The effects will be less serious where the economic incentives for roll-out are less developed. Restriction on resale of roaming to other licensed operators is also a restriction. However, given O2's new entrant status, the restrictions are justified by efficiency gains and limited to what is strictly necessary, provided the roaming is phased out under a strict timeframe imposed in the decision: all roaming ceases by 31 December 2008.

Commitments: N/A.

GERMANY - T-Mobile - O2 site sharing and national roaming (2006)

Court of First Instance of the EU, decision of **2 May 2006** relating to the European Commission's decision to clear under art. 101-3 mobile network sharing between O2 and T-Mobile.

Form of cooperation: contractual (no JV company) - same as above

Comments of the Court:

The Commission considered that site sharing and information exchange did not lead to restrictions of competition. However, national roaming does restrict competition, by affecting speed of coverage and roll-out, and also harmonizing quality and limiting price competition. Veto right over resale of roaming capacity to MVNOs also restricts competition.

The Commission determined that exemption is justified because of O2's weak position in the market, and because it would not otherwise be able to satisfy its coverage obligations. However, the exemption granted by the Commission is limited in time and geographic scope. O2 challenged, arguing that the agreement does not restrict competition.

The Court finds that in order to find a restriction of competition, the Commission **had to compare the effects of the agreement to the counterfactual**, i.e. what would have happened in the absence of the agreement. The Commission failed to examine what competition would look like in the absence of the agreement. Also, the Commission simply asserted that national roaming restricts competition without looking at precise evidence, or looking at amendments of the agreement.

Commitments: N/A.

6.7 Ireland²⁹

Fixed sector

Vodafone and Electricity Supply Board (“ESB”), the state-owned former electricity monopoly company, established a joint venture, Siro, in 2014 for the deployment of FTTH for 500,000 homes in 51 cities. Siro acts as a wholesale-only company, offering wholesale services to the partners (e.g., Vodafone), but also to about ten different third-party service providers, such as Digiweb. As of July 2019, Siro covered 250,000 homes in 45 towns. By comparison, the incumbent operator, Eir, has passed 300,000 homes with FTTH.

Overall, FTTH coverage remains low, with 13% of households covered in 2018 according to the European Commission’s Digital Scoreboard, while NGA coverage is almost full (96%).

Mobile sector

In 2014, Three and EIR agreed on a long-term network sharing deal until 2030, whereby companies share existing infrastructure and will share the costs of deploying new sites (including 4G). This deal was a response to one of the commitments requested by the European Commission for the Three-O2 merger (see box below).

Lessons: The deal between Vodafone and ESB shows that infrastructure sharing deals between telecommunications operators and utilities can stimulate investment while allowing for competition to develop, when they are properly designed. Infrastructure sharing agreements can also reduce the barriers to entry for smaller player, as illustrated by the deal between Three and EIR.

IRELAND - Three - O2 merger approved (2014)

European Commission decision of **28 May 2014** relating to the merger of Hutchinson 3G UK and Telefonica Ireland.

Form of cooperation: merger.

Comments of the European Commission:

The Commission had concerns that after the merger, Three could frustrate or terminate the network sharing agreement that Eircom, the third and smallest network competitor after the merger, currently has with O2 Ireland. This would have limited Eircom's options to achieve a nationwide coverage in Ireland, including for its roll-out of 4G/LTE services. H3G committed to offer Eircom to continue the network sharing agreement on improved terms. Given the importance of network sharing in Ireland, this will secure Eircom's options to achieve its roll-out plans and ensures that Eircom remains an effective and viable competitor. (Press release 28 May 2014)

²⁹ This case study on Ireland relies on the following sources: BEREC (2018), Berkeley Research Group (2017), Cullen (2019a), Cullen (2019b), “Siro now a serious challenger to Eir in fibre arms race,” The Irish Times, July 26, 2019, <https://www.irishtimes.com/business/technology/siro-now-a-serious-challenger-to-eir-in-fibre-arms-race-1.3967160>

6.8 Italy³⁰

In the mobile sector, there were various passive infrastructure sharing agreements between Vodafone and Wind and then TIM (August and November 2009), but no regulatory interventions other than a lease agreement between Wind 3 and Iliad imposed as a merger remedy on Wind and Hutchison 3G Italy.

In February 2019, Vodafone and Telecom Italia announced a joint venture, involving the fusion of their existing network of 22,000 towers into Inwit SpA (infrastructure arm of TI, of which Vodafone will receive a 37.5% share), with the intention to share active 5G network components in the future on contractual basis outside of the joint venture. This agreement builds on their existing passive sharing agreement over 10,000 sites. In March 2020, this agreement was approved, after being vetted by the European Commission due a complaint by Iliad. The operators agreed to commitments facilitating access of third parties (see box).

Later in June 2019, Fastweb, a fibre operator, and Wind-Tre agreed on the shared roll-out of a national 5G network, using Fastweb's dark fibre for backhaul, and sharing radio equipment and frequencies already held by both companies (probably using network slicing). Wind will manage the 5G network, while operators remain independent in their operational use of the network and commercial activities. The agreement also includes national roaming for Fastweb on Wind's existing network and wholesale access for Wind to Fastweb's fibre network. In January 2020, rival operator Iliad asked courts to block the deal.

On the fixed network, Italy has SMP regulation on the incumbent's FTTH network, and sub-loop unbundling and duct access.

In 2012, Telecom Italia and Fastweb agreed on co-investment for FTTC infrastructure, essentially to share the costs of the public works involved, while the actual networks remained separate. After the entry of Enel Open Fibre in 2015, TI and Fastweb created the joint venture "flash fibre", owned 80% and 20% respectively, to upgrade the network in 29 cities already covered by FTTC to FTTH by installing fibre between street cabinets and buildings, with exclusive access to the JV partners (these can then make wholesale offers).

In February 2017, the Italian competition authority started an investigation into this agreement after receiving a complaint. The agreement was authorized in April 2018, after the partners responded to concerns about strategic alignment by offering six remedies: "precise timetable for the implementation of the FTTH network (30 per cent by 2017; 70 per cent by 2018; 85 per cent by 2019; 95 per cent by 2020); abolishment of the pre-emptive right on the network capacity of Flash Fiber; the introduction of autonomous offers of VULA and NGA bitstream services by Telecom Italia and Fastweb on non-discriminatory terms; backdating of the closing date of Flash Fiber to 2035; modification of co-investment agreements; and measures to prevent the exchange of commercially-sensitive information between the parties through Flash Fiber" (see box).

Vodafone rents lines from ENEL Open Fiber (wholesale-only operator).

³⁰ The case study on Italy relies in particular on Berkeley Research Group (2017), Cullen (2019a), Godlovitch and Neumann (2017), <https://advanced-television.com/2018/04/12/italy-oks-tim-fastweb-ftth-deal/>.

Lessons: Italy first based its approach on SMP fibre regulation of the incumbent, Telecom Italia. Due to a lack of competitive pressure, very little fibre was actually rolled out. Only the entry of a wholesale fibre operator of the energy provider ENEL changed the competitive landscape and induced more investments and the co-investment agreement between TI and Fastweb. The latter agreement needed to be refined to allay concerns about restrictions of competition, in particular with respect to access to third parties and information exchange between the partners.

ITALY - Telecom Italia - Fastweb fibre deployment (2018)

AGCM decision of **28 March 2018** relating to Telecom Italia's and Fastweb's cooperation to deploy fibre optics in 29 major Italian cities.

Form of cooperation: creation of a new JV company.

Comments of the competition authority:

- AGCM is concerned to precisely delineate the boundaries of the cooperation in terms of geography, in terms of products and duration (limited to 2035);
- To ensure roll-out schedule with external verification;
- To strengthen the competitive structure of wholesale service offerings, by ensuring that third party operators can choose to buy passive fibre from the JV, or buy VULA or NGA bitstream from either of the parents.

Commitments:

- Specific roll-out milestones, to be verified by an independent auditor;
- Removal of clauses in the agreement that would limit the availability of capacity for third party operators, and a guarantee of availability of a certain number of fibres to third party operators; plus an obligation to conclude agreements to provide third party operators access to vertical segments.
- Both parents must provide VULA and NGA bitstream offers to third operators, and provide access to passive infrastructure on transparent, non-discriminatory, fair and reasonable conditions.
- Commitment to terminate the cooperation by 2035, i.e. just the time necessary to recover investment;
- Reduction in the parents' obligation to use infrastructure created by the JV company; outside of central areas of the 29 cities, parents can sign agreements with other companies; JV will not be used for public tenders for rural projects; removal of clause foreseeing cooperation of the parties outside of 29 cities.
- Measures to hinder the exchange of commercially sensitive information between the parents.

ITALY - Vodafone - Telecom Italia site sharing (2020)

European Commission decision dated **6 March 2020** approving the acquisition of joint control over INWIT by Telecom Italia and Vodafone.

Form of cooperation: creation of a JV company that will own and manage all the towers of Telecom Italia and Vodafone in Italy.

Comments of the Commission:

Mobile network sharing is intended to promote 5G roll-out. The creation of INWIT is part of a broader set of cooperation agreements which:

- extend to all of Italy that parties' existing agreement to share passive parts of their networks;
- permit sharing of active parts of the network (signal processing equipment) for 2G, 4G and 5G outside municipalities of more than 100,000 inhabitants, including their suburbs.

Core networks and spectrum are not shared. With 5 MNOs, the Italian market is less concentrated than in other Member States, which was a factor taken into account by the Commission. Commission concerns relate to access by third party operators to sites. The Commission's press release, and resulting commitments, also show concerns for preserving the parties' competitive incentives to invest in network upgrades for 5G capacity in the shared active equipment. At the Commission's request, the parties reduced the geographic scope of their active sharing to ensure that 30% of the Italian population and more than 33% of data traffic are excluded from the cooperation. These excluded areas correspond to the most densely and highly populated cities and centres of economic importance. In these areas, the parties will continue to compete aggressively in network quality.

Commitments:

The parties agreed to reduce the geographic scope of cooperation for active sharing to exclude Italy's most highly populated cities, thereby ensuring that 30% of the Italian population is excluded. As regards the consolidation of towers, the parties agreed to the following commitments to address concerns about third party access to towers:

- The JV will make available to third operators space on 4,000 towers in municipalities with more than 35,000 inhabitants, on reasonable non-discriminatory terms, and will give publicity to the towers made available.
- The JV will be required to respond to requests within a fixed time, and may only refuse for justified technical reasons.
- In case of disagreement, a fast-track dispute resolution mechanism will be applied with an independent expert;
- INWIT, Telecom Italia and Vodafone will not exercise early termination for any existing hosting contracts in place, and will offer the opportunity to extend those contracts.

6.9 The Netherlands³¹

The Netherlands has full NGA coverage, but stands at the average for FTTH coverage in Europe, with 35% of households covered with FTTH in 2018 according to the European Commission's Digital Scoreboard. LTE availability is also very high, over 90%.

Mobile sector

Mobile operators have to accept reasonable request for site and mast sharing. RAN sharing with spectrum pooling and core network sharing are not allowed.

Tele2, which has since been acquired by TMO, entered the market in 2014 with a 4G license and entered a national roaming agreement with T-Mobile for 2G and 3G coverage. Otherwise, there is no sharing agreement beyond site and mast sharing.

Auctions for 5G were supposed to be held in June 2020. The deployment of 5G may raise new challenges for operators, and push them to agree on infrastructure sharing deals. The regulator, ACM, announced in December 2019 that it would publish guidelines for 5G infrastructure sharing.

Fixed sector

We found no evidence of co-investment agreements.

Lessons: The fixed and mobile broadband markets have developed well, without recurring to infrastructure sharing, except for the sharing of sites and masts. The deployment of 5G may represent a new challenge, though, and lead operators to join forces.

³¹ This case study on the Netherlands relies on the following sources: ACM (2019), Cullen (2019a), Cullen (2019b), OECD (2014).

NETHERLANDS - KPN - Reggefiber fibre deployment (2018)

Court of Appeal decision of **14 February 2018** relating to the acquisition by KPN of sole control of Reggefiber, a JV company previously created between KPN and Reggeborgh Glasvezelinvesteringen BV.

Form of cooperation: separate JV fibre company subsequently acquired in its entirety by KPN.

Comments of the Court:

The ACM authorized the acquisition, and Vodafone challenged the decision. The main ground for the ACM's decision was that sector-specific regulations, in particular unbundled fibre access obligations, will mitigate any competitive harm.

The main competitor to KPN is the cable operator Ziggo, which was acquired by Vodafone.

Prior to the acquisition, Reggefiber's wholesale tariffs for fibre access were below the regulated price cap. Vodafone complained that after the merger, Reggefiber would likely increase prices. However, the ACM considered that even if Reggefiber increases its prices, there would be no competition violation if the increases remain below the maximum regulated price cap for unbundled fibre access. The Appeals Court found that ACM's regulated price caps for unbundled fibre access (cost-based) take into account the preservation of competition and investment risk (via WACC). They provide a sufficient protection against wholesale price increases that might result from the acquisition.

6.10 Portugal³²

Since 2001, the sharing of passive elements of mobile networks has been encouraged by the national regulator, while the sharing of frequencies and the core network were ruled out. RAN sharing was permitted, but not taken up by operators.

A duct sharing obligation, involving both telecom and non-telecom operators, was introduced in 2009 and led to widespread roll-out of fibre networks by individual operators. Coverage in several rural regions was supported by competitive bidding for subsidies. Still, in Portugal there are several commercial sharing agreements for mobile and fixed infrastructure, usually involving both and structured as long-term commercial reciprocal access agreements. These agreements tend to be voluntarily communicated to the competition authority (who saw no need for intervention) and to the NRA (who must be notified of civil infrastructure sharing agreements). The competition authority published a report on network sharing in 2013.

Before 2010, Optimus and Vodafone, two mobile operators, shared masts and sites. In 2010, they concluded a fibre sharing agreement for 400,000 homes (10% of households) under reciprocal access. In 2016, Vodafone exercised the option to buy out Optimus that it had been granted during the 2013 merger between Optimus and ZON (the cable operator, now called NOS) in order to protect its access.

In 2014, Vodafone and DStelecom (an infrastructure company already operating some subsidized rural networks) signed a wholesale access agreement covering circa 200,000 (5% of) households. Also, in 2014, Vodafone and Altice (ex-Portugal Telecom) agreed to co-invest in the coverage of 900,000 (22% of) households, half to be done by each partner. Altice and Vodafone are investing separately in further expansion.

In September 2017, Vodafone and NOS announced a co-investment in dark fibre for 2.6m (52% of) homes, plus at least 200 mobile towers. In 2019, an additional deal was made with DStelecom (i.e. a Memorandum of Understanding was signed), for covering up to additional 1.2m homes. At the start of February 2020, Vodafone and NOS announced an extension of their existing partnership to the sharing of their mobile infrastructure on a national level. While the firms stated that spectrum will not be shared and that firms retain their strategic and commercial independence, they did not reveal the degree of the planned sharing.

Lessons: Portugal adopted a laissez-faire approach concerning NGA roll-out, based on the early introduction of an effective duct and pole access regime. As a result, Portugal has one of the highest rates of NGA coverage in Europe, to which co-investment has contributed. None of the agreements gave rise to competition concerns. A proposal for mobile infrastructure sharing agreements arose in 2020 in preparation for the transition to 5G.

³² The case study on Portugal relies on the following sources in particular: Cullen (2019a), WIK (2019).

6.11 Spain³³

Fixed sector

In Spain, operators have made various reciprocal access deals for the deployment of FTTH. The deal between Telefonica and Jazztel was established in 2012, and concerns 1.5 million households covered by each partner, for a total of 3 million households. Vodafone and Orange established an agreement in 2013 for the coverage of 3 million households by 2015 (1.5 million households each). Each partner remains independent for the deployment and operation of its network. Following Vodafone's acquisition of cable operator ONO, the arrangement now gives bitstream access to ONO's network to Orange.

Finally, as a result of the Orange/Jazztel merger, Orange and MasMovil agreed on an access deal in 2016. Orange gives wholesale bitstream access to its nationwide FTTH network to MasMovil, and in addition, the two operators agreed on a reciprocal access deal where they deploy separate networks for a total of 4.4 million households, with reciprocal access. The deal was extended in 2018 and 2019. Commercial infrastructure sharing agreements were established between Telefonica and Vodafone in 2017 and between Telefonica and Orange in 2018, which are close to long-term access contracts. A reciprocal access deal was reached also between MasMovil and Vodafone in September 2018, for a total coverage of 1.9m households.

Access to fibre networks for third parties was not mandated by the regulator until 2016. When introduced and required (as bitstream access), it has been restricted to areas where the regulator does not expect effective competition to emerge. Regulatory forbearance is maintained in municipalities where at least two competitors to the incumbent operators have 20% coverage, which corresponds to 66 municipalities with 35% of households. In these municipalities, wholesale access is offered on a commercial basis.

In terms of market outcome, FTTH coverage is particularly high in Spain, with 77% of households covered as of 2018 according to the EU Digital Agenda Scoreboard. According to WIK (2019), 38% of households have access to three or more ultrafast broadband providers. According to the same report, prices for ultrafast broadband services have not increased since 2009 when the forbearance policy was established, though they remain at relatively high levels compared to other European countries. NGA coverage was at 88% in 2018 according to the EU Digital Agenda Scoreboard.

Mobile sector

Spain's 4G coverage is high, at 95%. Network sharing is allowed in Spain and site sharing can be mandated for environmental reasons.

Orange and Vodafone established a reciprocal access arrangement in 2005 for the active infrastructure in rural areas with less than 25,000 inhabitants. The deal was extended in 2019 to municipalities up to 175,000 inhabitants. Sharing is active (RAN sharing) and all mobile technologies are included (2G, 3G, 4G and when available, 5G). Each operator deploys its own network independently in the rest of the country.

In 2013, Yoigo (MasMovil's MNO) and Telefonica agreed on a reciprocal access deal. In 2015, the national competition authority, CNMC, declared that the deal was anti-competitive due in particular to delays in deploying infrastructures, and fined both operators (see the box below).

³³ The case study on Spain relies on the following sources: BEREC (2018), Berkeley Research Group (2017), Cullen (2019a), Cullen (2019b), Godlovitch and Neuman (2017), WIK (2019).



As a consequence, this agreement no longer exists. In 2017, Yoigo entered a commercial national roaming agreement without joint development with Orange for access to the latter's 2G, 3G and 4G networks. In October 2019, the deal was extended until 2028 and now covers 5G networks, when available.

Lessons: In the fixed sector, Spain has relied on commercial reciprocal access deals to stimulate deployments, and achieved both very high coverage and strong service-based competition. In the mobile sector, the same model of commercial infrastructure sharing has applied, with also a very good outcome in terms of coverage.

Yet, the deal between Yoigo and Telefonica shows the risk that a roaming agreement can undermine investment incentives, and reduce the likelihood that infrastructure-based competition emerges in the long-run.

SPAIN - Telefonica - Yoigo site sharing and national roaming (2015)

CNMC decision of **16 July 2015** involving (i) the acquisition by Abertis Telecom of towers and related infrastructure from Telefonica and Yoigo, (ii) collocation and rationalization of both operators' equipment, (iii) national roaming by Telefonica on Yoigo's 4G 1800 MHz access network (iv) national roaming by Yoigo on Telefonica's 2G and 3G access networks, with expansion to 4G, (v) Yoigo acquiring new transmission capacity in the Telefonica network, and (vi) Yoigo having the right to commercialize converged fixed/mobile services using Telefonica's fixed offers.

Form of cooperation: transfer of towers to an independent infrastructure company, and contractual cooperation for the rest.

Comments of competition authority:

Roaming agreements restrict competition. But anticompetitive effects are offset by benefits to consumers because it allows the entry of a new network operator in Spain, bringing new competitive pressure to the retail market. Yoigo is also deploying its own 4G networks in urban areas. But several clauses are deemed excessive:

- a clause allowing Telefonica to veto deals between Yoigo and other MVNOs;
- a clause allowing Yoigo to roam on Telefonica's 4G network even in urban areas where Yoigo has deployed 4G;
- the clause allowing Telefonica to roam on Yoigo's 4G network.

The following agency agreement clauses are problematic:

- a clause allowing Telefonica to terminate the agency every 6 months;
- prohibition for Yoigo to market to existing Telefonica customers;
- Telefonica's freedom to limit the services available to be sold under the agency agreement.

Infrastructure sharing is pro-competitive provided third-party operators are not excluded from the infrastructure without sufficient objective justification.

Commitments: N/A

6.12 Sweden³⁴

Since 2003, site and mast sharing is mandated if it is needed to pursue environmental and health goals and local planning needs.

Sweden is one of the few cases in Europe (the others include Denmark and Poland), where two mobile operators share both the physical network infrastructure and radio spectrum (MOCN). At the UMTS auction in 2000, the incumbent operator Telia did not win spectrum. As a result, it merged with Sonera and together with rival operator Tele2 created the sharing joint venture "SUNAB". This joint venture used Telia's existing network, Tele2's spectrum, and included the sharing of passive, backhaul and RAN infrastructure.

Competitors Hi3G (then a new entrant), Telenor and Orange created their own joint venture, "3GIS". Orange then exited the market in 2003 due to financial constraints of its parent company. Since both operators had spectrum, this joint venture was subject to the restriction that no more than 70% of the sites could be shared. As a result, these operators covered larger cities independently, while the joint venture concentrated on smaller cities and rural areas.

In 2009, TeliaSonera decided to build its own 4G network, and therefore Tele2 and Telenor created a new joint venture, "Net4Mobility". This joint venture competed for and won 4G spectrum, and received even more spectrum from its two partners. In 2019, the agreement was being revised to include 5G.

Both the national regulatory agency and OECD (2014) credited the agreements for Sweden's high mobile coverage of advanced services (3G and LTE) and high take-up of mobile broadband, while maintaining strong competition and low prices. The extensive use of municipal fibre networks was a contributing factor, with commitment by the operators accelerating roll-out of these networks, in a virtuous cycle of supply and demand. OECD (2014) also concluded that involvement of the NRA and operators before the build of networks paved the way for well-functioning sharing agreements, and that the sharing agreements in particular led to high coverage of less densely populated areas.

Lessons: While we did not have access to the specific details of the wide-ranging mobile sharing agreements in Sweden, it seems that these agreements were designed in a process that involved the NRA, which both gave rise to no later concerns about anti-competitive effects and a market characterized by strong competition and high coverage. A further contribution was the positive feedback loop between operator demand for fibre lines and roll-out by municipalities. The case of Sweden also shows that the strategic alignment of operators can change over time; therefore, agreements should contemplate an orderly process of dissolution.

³⁴ The case study on Sweden relies on the following sources: OECD (2014), WIK, 2016, Network Sharing im Mobilfunk und Festnetz-Mobilfunk-Konvergenz in der Schweiz, p. 87.

6.13 Switzerland³⁵

Fixed sector

Switzerland has no *ex-ante* access regulation for high-speed networks, nor symmetric duct access regulation or direct roll-out subsidies. Instead, in 2008, the national regulator ComCom created a roundtable for coordinating FTTH rollout between local utilities and Swisscom, the (majority state-owned) telecoms incumbent. The central network design feature was 4-fibre (2+2) infrastructure sharing, with wholesale offers by partners.

Swisscom made bilateral agreements with various local energy utilities (i.e. Basel, Bern, Geneva, Lucerne, St. Gallen and Zurich) for joint fibre roll-out. These agreements were notified to the competition authority for vetting. It found that some parts of the agreements were likely to restrict competition and did not rule out future prosecution related to these matters (see box). The agreements were adjusted accordingly.

By 2019, Swisscom had FTTH cooperation agreements with local utilities in about 60 municipalities and invested in FTTH on its own in another about 30 municipalities. FTTH covers not more than 30% of the national area, while Swisscom also has FTTC/B rollout (vectoring, G.fast) and local cable operators also provide high coverage (84%).

In 2010, Swisscom and the energy utility Groupe E created a joint venture to roll out fibre in the canton of Fribourg, notified as a merger. Instead of a simpler bilateral agreement, this tighter organizational form was deemed necessary because the aim was to cover the whole canton. The Swiss competition authority investigated the agreement and in 2012 found parts in violation of competition law (see box). The authority did not qualify the agreement as a joint venture but as an unlawful horizontal agreement affecting competition. The agreement was adapted in line with competition law, but did not endure. After the cancellation by Swisscom in 2017, the two parties agreed on a new contract in 2019.

Mobile sector

Passive sharing of mobile sites is widespread. While communications law allows the regulator to impose passive sharing of sites and ducts in case of necessity, these provisions have never been used. Rather, local authorities tend to impose sharing when sites are authorized, and operators have an incentive to share sites anyway because of site shortages.

Sharing is still based on the principles outlined by ComCom in the 2002 guidelines it published when the UMTS spectrum was licensed. Active sharing is not ruled out, but the guidelines define clear limits. The pooling of spectrum is not allowed, and only information necessary for operating the shared infrastructure can be exchanged; independent network planning and roll-out beyond the shared part must be guaranteed, and the network must be used independently by the partners. The revision of the telecommunications law, entering into force in 2021, will legalize in general the joint use of frequencies, subject to authorization by the licensing authority.

Though active sharing is allowed, it had little expression in the market. Between 1999 and 2003, Orange (now Salt) used 2G national roaming on Swisscom as a measure to support

³⁵ The case study on Switzerland relies on the following sources: Balmer (2014), Cullen (2019a), Cullen (2019b), Federal Gazette, Fernmeldegesetz (FMG) Änderung vom 22. März 2019. Available at <https://www.admin.ch/opc/de/federal-gazette/2019/2619.pdf>; Recht und Politik des Wettbewerbs 2011/3, 2012/01, 2012/02; Scherrer, Raphael, 2019. VHCNs and regulation in Switzerland, presentation, June. Available at <http://www.emergonline.org/download/164/public-shareable-documents/2349/vhcns-in-switzerland-2.pdf>; WIK, 2016. Network Sharing im Mobilfunk und Festnetz-Mobilfunk-Konvergenz in der Schweiz. Study for BAKOM and ComCom; [https://de.wikipedia.org/wiki/Salt_Mobile#Multiple-Operator_Radio_Access_Network_\(MORAN\)_mit_Sunrise](https://de.wikipedia.org/wiki/Salt_Mobile#Multiple-Operator_Radio_Access_Network_(MORAN)_mit_Sunrise)



entry. Since 2014, Salt and Sunrise share several sites on the basis of a Multiple-Operator Radio Access Network (MORAN) on a limited scale.

By 2020, the three mobile operators Swisscom, Salt and Sunrise each covered at least 98% of the population with LTE services, and 5G deployment has started.

Lessons: The case of Switzerland shows that concerning sharing agreements the devil is often in the details. For example, while it seems natural to reserve some exclusive rights to co-investors, these can easily run afoul with competition law. The same applies to the extent of information transmission between partners or internal transfer pricing policies. It is therefore necessary that partners, in designing their agreements, take into account previous experience to avoid clauses that will be deemed anti-competitive. Equally, it makes sense to have all agreements vetted, at least voluntarily, so that any potential restrictions to competition can be spotted while preserving their benefits. As the case of Switzerland also shows, agreements can function well for the original partners in the absence of such clauses.

SWITZERLAND - Swisscom - Groupe E Fribourg fibre deployment (2012)

Secretariat of the Competition Commission, final report of **16 February 2012** on creation of a JV between Swisscom and Groupe E for the deployment of FTTH in the canton of Fribourg, through a new JV entity called SLNC owned 60% by Swisscom and 40% by Groupe E.

Form of cooperation: contractual.

Comments of the competition authority:

Groupe E is a regional energy company, and the cooperation is part of a broader series of cooperation agreements between Swisscom and regional energy companies. Deployment is to follow a "four-fibre" model, which is the agreed industry standard in Switzerland. Although initially notified as a concentration, the competition authorities requalified the joint venture as a cooperation, not a full-function JV.

Anticompetitive provisions include:

- Building fibres are reserved for use of the JV partners only, thereby foreclosing access by third operators.
- Partners in the new entity have a pre-emptive right on shares, so new operators cannot become partners, which prevent them from benefiting from the infrastructure.
- Partners agree not to deploy any parallel infrastructure and thereby compete with the JV. However, Groupe E will be laying fibre with electric lines, so may in the future develop parallel network. The agreement provides for non-compete in the region after a party withdraws. This is anticompetitive territorial restriction.
- Agreements on use of ducts, sewers, may restrict competition if prices are too high. Also, restrictions on use/resale of duct, sewer, and space restrict competition.
- Agreements on minimum purchase obligations, and on pricing, for partners' purchase of fibre from the JV entity, restrict competition. The quantity conditions imposed are such that no third operator could qualify.
- The JV entity has no real autonomy. Pricing to third operators is in fact coordinated between the JV partner.

SWITZERLAND - Swisscom - Regional energy companies fibre deployment (2011)

Secretariat of the Competition Commission, final report of **5 September 2011** on cooperation between Swisscom and regional energy companies to deploy FTTH in the cantons of St. Gallen, Zurich, Berne, Lucerne and Basle.

Form of cooperation: contractual.

Comments of the competition authority:

Problematic clauses problematic include:

- Non-compete agreement - Swisscom refrains from making layer 1 offers
- Investment protection, which prevents parties from renting fibre to third parties below costs. This restricts their pricing autonomy.
- Compensation mechanism if a party's use of the network exceeds a certain threshold. This has the effect of softening competition by reducing incentives to develop economies of scale and increasing cost of usage by third parties.
- Information exchange. The compensation mechanism requires communication of detailed information on sales volume.
- Right of first refusal in case of sale of a party's interest in the network.
- Anti-circumvention rule, which prohibits sales likely to lead to circumvention of the investment protection of compensation mechanism.

6.14 United Kingdom³⁶

Active and passive network sharing for mobile networks is allowed in the UK. Site sharing has existed since the 1980s when the first mobile networks were deployed. In February 2002, O2 and T-Mobile announced a network sharing agreement for the deployment of a 3G mobile network in the UK, whereby each operator agreed to share mobile sites and roaming on each other's network. The agreement was cleared by the European Commission in 2003 (see box below).

At the moment, there are two active network sharing agreements, of the joint venture type.

Three and EE have set up a joint venture, Mobile Broadband Network Limited. This joint venture was initially established in 2008 between T-Mobile and Three, for active sharing of their national 3G infrastructures (RAN sharing with separate networks, MORAN) and passive sharing of their 4G infrastructures (site sharing). The joint venture continued after the merger between T-Mobile and Orange in 2010. Firms share the cost of rolling out the network proportionally.

Vodafone and O2 have also established a joint venture for sharing of their mobile infrastructure in 2012, called Cornerstone Telecommunications Infrastructure Limited ("CTIL"). The agreement includes 3G, 4G, and recently 5G, technologies. It involves the sharing of both passive elements (e.g., towers) and active elements (RAN), with this varying by location (London and certain cities on a passive-only basis, elsewhere on an active basis). The agreement was cleared by the Office of Fair Trading in September 2012. The deal corresponds to a reciprocal access arrangement for active sharing, where firms share the covered territory: Vodafone is responsible for the west of UK, Wales and areas south of London, whereas O2 is for the east of UK, Northern Ireland and areas north of London. Passive assets are managed through a joint venture company, which operates the sites for the two operators. In 2018 and 2019 amendments to this arrangement, the two operators decided to exclude some large cities from the agreement to achieve greater autonomy for each partner.

In both cases, OFCOM made a preliminary assessment, considering possible anti-competitive effects, in particular due to risk of foreclosure or pro-collusive effects of information sharing. For the Vodafone/O2 agreement, OFCOM required amendments, which were implemented by the firm.

These two network sharing agreements raised concerns when the Commission assessed the proposed Three-O2 merger in 2016 (see box below).

Following an agreement signed in March 2020, mobile coverage in rural areas is now to be delivered by the Shared Rural Network, a joint venture between all 4 MNOs (EE, O2, Three and Vodafone) and the UK government, with the operators contributing assets and cash and the government contributing cash.³⁷

As far as we are aware, there is no co-investment agreement for fixed networks to date in the UK. However, recently, BT has been advocating for a single fibre network in rural areas.³⁸

While NGA coverage is very high (at 95%), the UK is one of the countries in Europe with the lowest coverage for FTTH, with 4% of households covered according to the European Commission's Digital Scoreboard.

³⁶ The case study on the UK relies on the following sources: BEREC (2018), Berkeley Research Group (2017), Cullen (2019b), OECD (2014).

³⁷ See <https://www.gov.uk/government/news/shared-rural-network>.

³⁸ See <https://www.ispreview.co.uk/index.php/2020/01/examining-bt-groups-uk-single-rural-full-fibre-network-idea.html>.

Lessons: The UK has been the pioneering country for mobile network sharing. The different legal cases for the British market have shown the type of concerns that may arise with infrastructure sharing agreements, such as risks of foreclosure or collusive behaviour. The project of a Shared Rural Network initiates the moves towards a new model combining infrastructure sharing and State Aid.

UNITED KINGDOM - O2 - T-Mobile site sharing and national roaming (2003)

Commission decision of **30 April 2003** approving site sharing and national roaming between O2 UK and T-Mobile UK under article 81-3.

Form of cooperation: contractual cooperation.

Comments of the European Commission:

The Commission focuses on the following potential restrictions of competition:

Exclusivity by which each party agrees not to deploy 3G infrastructure outside of their own designated areas. Because this exclusivity is subject to a number of exceptions, including meeting market demands, the Commission does not view the provision as problematic. Exclusivity by which each party has priority access to sites of the other party: this limits the ability of third operators to access the parties' sites. Commission notes existence of symmetric site sharing obligation under art. 12 of the Framework Directive, and the fact that the parties revised the right of first refusal provision so as not to fix prices for third party access. The Commission concludes that these provisions do not lead to widespread foreclosure for third party operators since there is not an overall lack of availability of sites in the UK, and regulatory authorities can impose site-sharing under art. 12 Framework Directive. Information exchange is mitigated by safeguards in the agreement that prohibits the exchange of information on pricing, product development and launch plans.

National roaming creates significant restriction of competition, because it results in uniform quality, coverage and cost structure. However, the Commission allows an exemption under art. 81-3 because roaming allows better quality networks across a wider coverage area in areas where the economic incentives to roll out are lower, thereby allowing the parties to compete more effectively, and more quickly, spurring new product offerings and innovation. However, the period of roaming must be limited to 31 December 2007 for dense areas and 31 December 2008 for less dense areas.

Commitments: N/A.

UNITED KINGDOM - Three - O2 merger rejected (2016)

European Commission decision of **11 May 2016** relating to the merger of Hutchison 3G UK (Three) and Telefonica UK (O2).

Form of cooperation: merger.

Comments of the European Commission:

One of the concerns of the merger was the effect on

- the existing network sharing agreement (joint venture) between Hutchison 3G and T-Mobile UK, called MBNL. MBNL is a separate entity that manages the design and operation of the shared network;
- the existing network sharing agreement (JV) between Vodafone and O2, called Beacon.

All MNOs in the UK take advantage of the opportunity to use each other's passive infrastructure under a cross-operator site sharing agreement.

The Commission (in para. 1228 and following) describes concerns about network sharing.

"Network sharing arrangements require a certain degree of alignment of interests between the network sharing partners to function properly" (para 1230). "network sharing arrangements require partners that are willing to cooperate and compromise." (para. 1235)

"Cooperation and compromise are facilitated by a comparable situation both partners are in and by mutual co-dependence." (para. 1236)

"...mutual co-dependence...can be safeguarded by rigid exclusivity provisions that are protected by severe consequences... But it can also be ensured by the set-up of the governance procedures within the network sharing joint venture. If these procedures provide for mutual opportunities to harm each other, such arrangements will have a disciplinary effect on the partners." (para. 1237)

"This alignment of interest and mutual dependence is likely to be disrupted in both network sharing arrangements following the Transaction." 1239 ..."the merged entity ...could de-prioritise the shared network without inflicting its own services in the same way as the ones of its network sharing partner" (para. 1240)

"one theory of harm concerns reduced competition from either one or both of the other MNOs that are partners of the Parties in the network sharing arrangements, which could lead to a significant impediment of effective competition in an oligopolistic market featuring a limited number of players and high barriers to entry." (para. 1232)



“the Transaction might lead to a loss of synergies affecting the network sharing partners and allow opportunistic investment behaviour of the merged entity, thereby reducing industry-wide investments and, as a consequence, the level of effective competition which would have prevailed in the absence of the Transaction.” (para. 1233)

“The merged entity could...be incentivised to delay the roll-out of significant new network technologies until it finished consolidating its networks.” (para. 1287)

Commitments offered do not fully address the risks relating to existing network sharing agreements, particularly risks arising for non-alignment of interests, and risk of lower aggregate investment. The merged entity would have been part of both network sharing arrangements, MBNL and Beacon. It would have had a full overview of the network plans of both remaining competitors, Vodafone and EE. Its role in both networks would have weakened EE and Vodafone and hampered the future development of mobile infrastructure in the UK, for example with respect to the roll-out of next generation technology (5G), to the detriment of UK consumers and businesses. (Commission Press Release 11 May 2016)

Commission disapproves the merger.

Commitments: N/A

07

CONCLUSIONS

7. CONCLUSIONS

This CERRE report studies the implementation aspects of infrastructure sharing.

Infrastructure sharing is common in mobile markets, where it can take different forms, ranging from passive sharing of cell sites to active sharing of Radio Access Networks (RANs) and spectrum. Infrastructure sharing for new fibre networks is also becoming more and more frequent; one of the key new provisions of the EECC is intended to encourage fibre co-investment by permitting NRAs to grant SMP operators a holiday from strict access obligations in exchange for entering into qualifying fibre co-investment projects. Commercial co-investment agreements have also emerged in different countries.

From a social point of view, infrastructure sharing has pros and cons. We identified the following potential benefits of infrastructure sharing agreements:

1. Sharing of deployment costs, leading to faster and wider coverage and higher quality;
2. Sharing of operational costs, leading to lower prices;
3. Enhanced competition, benefiting consumers in terms of lower prices;
4. Facilitated entry for third-party operators.

The potential drawbacks which may arise in certain circumstances are due to the potential unilateral effects and coordinated effects of infrastructure sharing:

1. Incentive and ability to raise internal and/or external access prices to soften price competition at the retail level;
2. Lack of freedom for differentiation from partners on roll-out and other independent strategies;
3. Reduced incentives for unilateral investment resulting in lower total network investment than would otherwise be the case;
4. Exclusion of potential rivals through entry-detering access conditions for non-partners;
5. Cost disadvantage for non-partners that are not allowed to join the agreement;
6. Cherry-picking/free riding from late co-investors, which could deter investment in the first place;
7. Risks of explicit or tacit collusion, stemming in particular from information exchange between partners.

The market context and the type of technology deployed (fixed or mobile) will affect the magnitude of each potential benefit and drawback listed above.

The implementation of an infrastructure sharing agreement will also affect the potential benefits and costs of infrastructure sharing. Therefore, in this report, we have analysed how an agreement should be implemented to maximize benefits, while minimizing potential costs.

The first, key, implementation aspect is the choice of an operational model, which can be a full joint venture, a reciprocal access agreement or a one-way sharing agreement.

We showed that there are trade-offs for firms between these different models.

Joint venture arrangements, often involving the creation of a separate joint venture company, bring complementarities and synergies, imply strong commitment and allow for more coordination between partners, compared to contractual arrangements such as reciprocal access or one-way sharing. The latter type of arrangement, though, entails lower transaction costs, is more flexible and gives more incentives to operators to employ their specific know-how in the deployment and operation of networks.



From a social point of view, full joint ventures imply more total investment if there are strong investment spillovers between operators, and have also the benefit of bringing complementarities and synergies. By contrast, more limited contractual arrangements such as reciprocal access or one-way sharing are more conducive to investment if investment spillovers are negligible, facilitate the expansion and upgrade of the shared infrastructure, and limit the risks of unilateral or coordinated effects.

Whatever the operational model that is adopted, we argued that the design of the agreement is crucial to avoid potential negative unilateral or coordinated effects. In particular, in an agreement, the following rules should apply:

1. Access or transfer prices should not be set at excessive levels;
2. The strategic independence of each partner should be guaranteed;
3. In joint ventures, each partner should be allowed to offer wholesale access to the shared infrastructure, individually and independently;
4. Exclusivity provisions for entering the agreement should be kept to the minimum necessary;
5. The agreement should protect the investor against opportunism from late co-investors;
6. To minimize the risk of coordinated behaviour, each partner should retain its independence, information exchange should be kept to the minimum necessary, and termination rules should be detailed and explicit.

We also studied the following implementation aspects of infrastructure sharing agreements:

- When to regulate agreements, and when to leave them to the market;
- The interplay between infrastructure sharing and other regulatory provisions;
- Pricing of late co-investment;
- Infrastructure sharing with business users.

First, private incentives for infrastructure sharing do not necessarily coincide with the incentives for society. Thus, it may happen that an agreement will not emerge, whereas such an agreement would be socially desirable. In such a case, infrastructure sharing could be mandated. To avoid potential anti-competitive effects, infrastructure sharing agreements should be subject to *ex-ante* approval or *ex-post* assessment, with the list of important design features discussed above scrutinized.

Second, we argued that adding regulatory provisions that are substitutes for co-investment, such as access obligations, may promote opportunistic behaviour from entrants, reducing co-investment and ultimately harming investment. By contrast, regulatory provisions that complement co-investment, such as access to ducts and poles, facilitate co-investment and improve coverage.

Third, we discussed various methods to regulate late co-investment, in order to limit its negative impact on investment:

1. A partner that joins late could pay a “risk premium” for using the infrastructure;
2. Potential co-investors could buy a “co-investment option,” i.e., the right to ask for co-investment later by making a payment when the first investment is made;
3. Potential co-investors could commit to buy some minimum capacity once the infrastructure is rolled out.

Fourth, the regulatory aspects of infrastructure cooperation with MNOs, third or neutral parties, and public-private partnerships, should be subjected to further study.



Finally, in this report, we discussed the experience in various European countries regarding mobile network sharing and fixed co-investment, with a review of the relevant legal cases when available.

Some general lessons can be drawn from the country cases:

- **The drawbacks of infrastructure sharing discussed above are real concerns, and have been addressed in various cases;**
- **Very different forms and intensities of infrastructure sharing have taken place, and they are mostly considered successful;**
- **There is not one best form, but it is important to address the concerns that we discussed above when the agreements are designed.**

The legal cases show that infrastructure sharing agreements are generally viewed favourably by competition authorities as fostering faster network roll-out and increased competition, and that there is not one single form of cooperation that is favoured by competition authorities. The cases show that infrastructure sharing transactions, regardless of the form, must take the following anti-competitive effects into account (which largely overlap with the drawbacks highlighted above):

- The infrastructure sharing involving new network investment should result in more and faster total network roll-out, or more and faster network upgrades, than would otherwise be the case in the absence of cooperation.
- As a general matter, infrastructure sharing with limited geographic scope will create fewer competition concerns than sharing covering large parts of a country; sharing in rural areas will create fewer issues than sharing in urban areas.
- Sharing of passive network elements will raise fewer competition issues than sharing active network elements, such as RAN sharing.
- The pricing of wholesale inputs (passive and active infrastructure, maintenance services) should be analysed both with regard to their impact on the retail pricing strategy of the parties (the risk of price coordination), but also with regard to access prices charged to third party operators (risk of foreclosure).
- Where some party's incentives are not aligned with its contractual investment or maintenance obligations, there is a significant risk of anticompetitive behaviour regardless of what is written in the contract. Therefore, infrastructure sharing deals should be avoided or carefully scrutinized where there is a mismatch in incentives (for example, if one of the parties already has a cable network in a zone covered by the party's co-investment commitment).
- Restrictions to third party access to infrastructure should be eliminated or reduced to the strict minimum necessary for the infrastructure sharing involving new network investment to be viable.
- The competitive impact on third party operators of infrastructure sharing will also depend on the existence or not of regulated wholesale access remedies, as well as in co-investment projects the openness to further co-investors.
- Information exchange must be limited to what is strictly necessary, including if necessary the organization of internal Chinese walls.

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8. REFERENCES

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