Antitrust, Vol. 35, No. 3, Summer 2021.

Collaboration and Combination Due to 5G: Unlocking Investment or Reducing Competition?

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With its promise of improvements to performance and functionality, 5G is the next generation of wireless technology. However, the business case for 5G investment remains unclear.

The upgrade from 4G to 5G and the expansion of 5G networks requires significant investment from mobile network operators (MNOs). This need for new capital expenditure arrives at a time when, even though connections and data usage by consumers are increasing, MNO revenues and average revenue per user (ARPU) have been flat or declining for several years. This is putting pressure on current MNO business models.

New use cases that would enable MNOs to monetize 5G may be on the horizon, but it is unclear when they will arrive and what types of new revenue streams they will offer. At this stage, it is also unclear whether the COVID-19 pandemic will exacerbate these challenges or accelerate the development and adoption of new use cases.

These trends and market uncertainties are putting pressure on MNOs to achieve investment efficiencies through mergers, or by cooperating through jointly deploying and sharing elements of their networks (known as "network sharing agreements" (NSAs)). Both mergers and NSAs have the potential to benefit consumers through increased investment. By improving the economics of 5G investment, mergers and NSAs may increase the scale of investment and the speed of 5G roll out. However, they may also reduce competitive tension between MNOs and dampen their incentives to invest. Which development prevails is likely to be fact specific to the case at hand, though recent cases and statements by regulators shed some light on the factors that are likely to tip the balance one way or the other.

Further, 5G raises new questions on how operators will compete in the future (for example, the requirement under 5G for networks with an increased density of cell towers may make investment more important), which may mean past precedent is of less value going forward. In addition, new technologies, such as virtualization and network slicing (which allow MNOs to operate multiple "virtual networks" over a single shared physical network), may mean that the software that operates the network becomes more important for determining network quality than the underlying hardware (i.e., the physical network). This could prompt rethinking the competitive implications of sharing physical infrastructure. It is therefore important that competition analysis keeps pace with technological developments in mobile markets.

Background on the Transition to 5G

In pure technical performance terms, 5G is a step change. Compared to 4G, 5G promises to offer increased speeds (both peak and user experienced speeds), more reliable coverage and reduced latency (the response time for two devices to communicate with each other), as well as greater power efficiency, mobility, traffic capacity (in a given area), and connection density (number of connected devices in a given area).[1] For example, 5G has the potential to deliver speeds of 1 Gbit/s and average 5G speeds are currently over 100 Mbit/s (around 10 times faster than average 4G speeds).[2]

5G differs from 4G in that it will increase the "spectral efficiency" of existing spectrum bands (i.e., it can offer higher speeds/capacity using existing spectrum holdings), but it will also use "mmWave bands," which have not previously been used to provide mobile services. Spectrum in the mmWave bands is very high frequency and provides very high capacity. However, this high frequency means it cannot travel very far or through objects. Thus, much "denser" networks will be required to provide mmWave based services, where density refers to the number of sites required to provide coverage in a given area.

The roll out and expansion of 5G networks will offer simultaneous, high-speed transmission through the mobile internet to many more devices than is possible today, potentially enabling developments in technologies ranging from driverless cars and delivery vehicles to virtual reality glasses

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and wearable devices that alert doctors of medical issues as they arise.

While 5G promises considerable benefits for consumers and the economy more generally, the costs of deploying the infrastructure are substantial, for two key reasons:

(1) The key spectrum bands for 5G (the 'C-band' and mmWave spectrum) have only recently started to be licensed or used by MNOs,[3] and
(2) A much denser network of base stations is likely to be required to deliver true 5G speeds, due to the poor propagation characteristics of mmWave spectrum.[4]

Operators will need to construct and operate a network with many more base stations than they presently operate. McKinsey estimates that the additional total cost of ownership (i.e., opex and capex) could peak at between 60–300 percent of current spend, depending on data growth rates.[5]

While operators are expected to incur large costs rolling out a 5G network, revenue and ARPU have been flat or falling in recent years. For example, in the United States, mobile connections and revenue for wireless carriers were closely correlated until approximately 2011, after which connections have continued to grow but mobile revenue has remained relatively flat.[6] As a result, ARPU has been declining over the same period.[7]

Falling ARPU, which likely reflects lower quality-adjusted prices, is not necessarily a bad thing.[8] Competition that drives lower prices and higher-quality products is, in fact, a good thing for society. The exponential increase in data consumption, in conjunction with increased speeds as new technologies are rolled out, suggests that consumers are benefiting greatly.

Declining ARPU could also be the result of a change in connection mix. For example, an increase in low-revenue connections (e.g., growth in low-revenue segments of the "Internet of Things" (IoT) or "machine-to-machine" (M2M) applications that enable connected devices to exchange information and perform actions without manual human assistance) could materialize as both a decrease in ARPU and an increase in total revenue since it represents a new revenue stream.

Finally, the fall in ARPU could also indicate that we have reached a ceiling on what consumers are willing to pay for ever-increasing mobile speeds and capacity. Of course, MNOs do not need to charge an explicit premium for 5G if they can achieve the same outcome by selling higher data allowance packages that are 5G only at a higher price (in effect, bundling 5G and large data caps in a more expensive package). However, if market practice continues to move towards plans with no data caps, this could potentially be a difficult pricing strategy to implement.

Of course, historic falling revenue is not a problem if consumers are willing to pay more for 5G, either through existing mobile users paying a premium or as a result of new technological advances that create new revenue streams. At this stage, however, it is neither clear whether MNOs will be able to charge a material premium for 5G nor when new technology-driven revenue streams will arrive.

The long-term impact of the COVID-19 pandemic on MNOs around the world is unclear. While some operators reported declines in mobile traffic during the pandemic,[9] others reported increases.[10] Declines in mobile traffic may reduce the pressure on network capacity and lessen the need for operators to upgrade to 5G in the near-term. However, if mobile traffic does increase, 5G may be a more cost-effective way of expanding network capacity. Therefore, the COVID-19 pandemic may exacerbate some of the pressures described earlier in this section, though the long-term impact is presently unclear.

As a result of the financial pressures MNOs are facing, two notable trends have emerged:

(1) Smaller MNOs have been merging and combining with larger rivals, including two recently litigated four-to-three mergers in the U.S. and Australia and the 'four-to-three wave' that happened in Europe beginning in 2012 (i.e., cleared acquisitions in Austria, Ireland, Germany, Italy and the Netherlands; a blocked transaction under appeal in the UK; and an abandoned deal in Denmark),[11] and
(2) MNO infrastructure sharing, which traditionally involved only passive infrastructure, is moving up the value chain into active infrastructure and attracting regulatory scrutiny (e.g., the ongoing European Commission investigation into the NSA between O2 CZ/CETIN and T-Mobile CZ in the Czech Republic).[12]

The prospect of gaining a first-mover advantage may incentivize some MNOs to immediately and independently invest in 5G infrastructure. However, the scale of the investment required, combined with the market uncertainty, may mean that the incentives might not be the same for all MNOs. In fact, some MNOs may be well served by waiting for this demand uncertainty to be resolved (i.e., a second mover advantage) and by observing how successful the initial investment by first movers is before investing themselves.

A number of papers have considered the empirical relationship between concentration in mobile markets and investment/quality outcomes, with some finding a positive relationship and some finding no evidence of a positive relationship.[13] Of course, while empirical analyses that look across markets are informative about the average effect of increases in market concentration on investment/quality, the overall consumer impact of any individual potential future consolidation will depend on the specific facts and circumstances of the transaction itself (including market conditions prevailing in the country at the time). Further, while these studies examine the historical relationship between concentration and investment/quality outcomes, the significant anticipated step change in the mobile sector with the transition to 5G means that past performance

may not necessarily be the best indicator of future impacts. In the remainder of this article we explore the case-specific factors influencing the impact of mergers and NSAs on 5G investment.

Network Sharing Agreements as an Alternative to Mergers to Unlock 5G Investment

The most extreme form of collaboration occurs when two MNOs merge. A common question in competition analysis is whether alternative arrangements, such as infrastructure sharing, could allow MNOs to achieve similar efficiencies to a merger, but with less harmful effects on competition. NSAs allow multiple MNOs to use the same physical infrastructure to provide mobile services. NSAs therefore generally benefit consumers in terms of faster rollout, cost savings, and improved coverage. However, in some circumstances they may have a negative impact on competition.

Infrastructure sharing has typically been viewed by regulators, including the European Commission, as more benign to competition than a merger, particularly when it involves the sharing of passive, rather than active, infrastructure. "Passive" refers to sharing passive physical infrastructure such as sites and towers, whereas "active" refers to sharing the active electronic equipment such as the radio access network (RAN), which includes the antennas that transmit signals between a cell tower and a consumer's mobile phone.

Both passive and active sharing reduce the sharing parties' costs, though the magnitude of cost savings may be greater in the case of active sharing.[14] However, the concern is that active sharing, which goes beyond the sharing of passive infrastructure and includes active components of the network, may restrict the sharing parties' ability to differentiate their networks and services, thereby weakening competition. Within active and passive sharing, there are also different NSA models, which involve sharing different assets,[15] which may have different implications for competition.

The net impact of NSAs on competition depends on the balancing of efficiencies and potential anticompetitive effects.

NSAs can generate procompetitive effects. An NSA reduces the costs of infrastructure as it avoids duplication of some network elements. Depending on the degree of sharing, the parties may only need to build out one set of sites to enable each other to provide coverage to their respective customers. There will be lower capex and opex from building one shared network rather than two fully independent networks.[16]

To the extent that the reduced costs of network infrastructure lower MNOs' marginal (i.e., variable) costs, MNOs have greater incentives to pass cost savings on to consumers by lowering prices and/or improving quality.[17] Fixed cost savings can also benefit consumers if, for example, the additional cashflows result in more investment, with a resultant increase in quality and/or coverage.[18] The reduced costs of building and maintaining network infrastructure may also enable the sharing parties to increase quality of service by building a denser network than they otherwise would have found profitable to provide individually.

However, NSAs can also give rise to anticompetitive effects. An NSA may result in unilateral effects if it unduly restricts the ability of the sharing parties to differentiate their networks and offers at the retail level.

Under certain circumstances, NSAs may restrict the ability and reduce the incentives of the sharing parties to differentiate their services, such as by hindering network quality improvements or delaying deployment of new technologies, compared to a counterfactual where the parties rolled out independent networks. The extent to which this may raise concerns will depend on the closeness of competition between the sharing parties and the competitive constraints imposed by remaining MNOs. MNOs with an NSA may still be able to differentiate their services if there are differences in spectrum holdings between the parties and if they retain the operational freedom to deploy additional spectrum, technologies and sites on a standalone basis.[19] The degree of freedom depends on the network sharing model adopted and the assets that are shared. However, even with network sharing at the wholesale level, MNOs can still differentiate their services at the retail level by offering plans with different data allowances and speeds, for instance.

An NSA may also give rise to coordinated effects if the increased transparency and symmetry between the sharing parties facilitates tacit collusion in the retail market. Awareness of each other's investment plans (given the need to jointly plan common infrastructure) may increase each sharing party's ability to predict and respond to the other's competitive behavior, which may facilitate tacit collusion. In addition, due to the joint operation of network infrastructure, there may be some commonality of costs, which may further enhance the ability of parties to tacitly collude.[20]

The number of active NSAs globally has increased in recent years.[21] As NSAs have involved more active sharing, regulatory scrutiny of those arrangements has heightened, given the greater risk of reduced competition between MNOs. Going forward, the pressures on MNOs to collaborate, given the substantial investment costs associated with 5G, are likely to result in active NSAs playing an even greater role in the mobile industry. This also has implications for the assessment of merger proposals by antitrust authorities—if competition authorities consider active NSAs to be problematic, they may not accept an NSA as a counterfactual for merger analysis.

How Mergers Can Unlock 5G Investment: Lessons from Two Recent Four-to-Three Merger Cases

The issue of 5G network investment was at the heart of two recently litigated four-to-three mergers. In both the Sprint/T-Mobile merger in the United States and the VHA/TPG merger in Australia, the level of investment that would be made by the parties in the absence of the merger and the

ability of the newly created firm to compete against the larger and better-resourced first and second players in each market were important questions in both of these transactions.

T-Mobile and Sprint were the third and fourth players respectively in the U.S. mobile market. Following a settlement with the Department of Justice in July 2019, subject to divestment undertakings (which set up Dish as a fourth player), the merger was unsuccessfully challenged by state attorneys general in the U.S. District Court for the Southern District of New York.[22]

Similarly, VHA and TPG were the third and fourth players respectively in the Australian mobile market. In the fixed market, TPG was the third player and VHA was the fourth. Following a statement in May 2019 that the Australian Competition and Consumer Commission (ACCC) intended to oppose the merger,[23] VHA sought a court declaration that the proposed acquisition would not substantially lessen competition. The Australian court found in VHA's favor in February 2020.[24]

In both instances, the companies argued that the proposed merger between the third and fourth player would create a stronger third player that would provide a greater competitive constraint than the two firms would be able to provide separately.[25] This argument ultimately prevailed in both cases, though not without contentious litigation and, in the case of T-Mobile/Sprint in the U.S., an undertaking to set up Dish as a fourth player.

There are several conceptual reasons why a merger might lead to increased investment, including improving the business case for investment, relieving capital constraints, combining scarce spectrum holdings, and reducing network build costs by combining spectrum in different bands.

Many investments in telecommunications networks are lumpy and fixed costs are high. As a result, the increased scale and scope from combining two networks generally improve the business case for investment in common/shared network assets. In the VHA/TPG merger, for example, regulators found that combining the fixed and mobile networks would enable the merged company to spread the same costs over more customers, improving the business case for investment in shared infrastructure.[26]

The ability of one of the players to finance investment absent the merger was a key issue in both the VHA/TPG and T-Mobile/Sprint mergers. In VHA/TPG, the evidence suggested that VHA was facing financial difficulties that would not be resolved absent the merger, which impacted its ability to invest.[27] The merged entity would have an improved ability to fund network investment due to a stronger balance sheet, improved access to debt and equity funding, cost synergies, and financial benefits from economies of scale.[28]

The VHA/TPG decision also asserted that the increased ability to invest would allow a faster rollout of 5G, stating that

> MergeCo's ability to invest additional capex in its network will enable it to offer high-quality 5G services to customers far sooner than Vodafone or TPG would be able to alone. In doing so, MergeCo will have the opportunity to become a more effective competitive constraint on Telstra and Optus.[29]

Similarly, in T-Mobile/Sprint in the U.S., the court was concerned with the viability of Sprint as a competitor given its financing issues, stating: "The weight of the evidence at trial establishes that Sprint is caught in a vicious cycle caused by its inability to finance meaningful network investment, which perpetuates a low-quality network that drives away customers and limits Sprint's ability to generate the cash necessary to reduce its financial constraints."[30]

Noting the narrow applicability of this "weakened competitor" defense,[31] the court explored whether there were any competitive means other than the merger to resolve Sprint's competitiveness issues, ultimately concluding that there was not.[32]

Network capacity can be expanded in several ways: by increasing the number of sites, investing in more efficient equipment such as 5G, or increasing spectrum holdings. The latter increases the capacity of the existing network, but also means the capacity provided by any new investments also increases. In this sense, increased spectrum holdings reduce the incremental cost of expanding capacity. This was the case in T-Mobile/Sprint,[33] in which the court's decision explicitly recognized that the increased network capacity resulting from the merger would release funds which could then be redirected to accelerating the 5G rollout.[34]

Different spectrum bands have different uses, with low-frequency spectrum providing superior coverage but low capacity and high-frequency providing poor coverage but high capacity. In T-Mobile/Sprint, T-Mobile had substantial low-band spectrum that Sprint lacked, while Sprint had substantial mid-band spectrum. The parties argued that having a broader spectrum portfolio would allow more efficient spectrum use leading to cost efficiencies, since low-band spectrum can provide greater coverage with fewer sites.[35]

There are, of course, other impacts on competition besides the investment effects we have described, including a reduction in competitive tension from having fewer players in the market (both at the network and retail level). Any procompetitive effects of investment must be weighed against potential competitive detriments to determine if, on balance, the merger is pro- or anticompetitive.

Another issue which could arise is whether the efficiencies described above are "merger specific." In other words, could the efficiencies be achieved by an alternative arrangement that does not involve a full merger? Indeed, in VHA/TPG in Australia, the ACCC's economic expert argued that the benefits described above were not merger specific given they could be achieved outside of the merger by an NSA. This argument was rejected as it was raised as a hypothetical possibility, without consideration of the specifics of what an NSA might look like between VHA and TPG and whether it would replicate the benefits of the merger.[36]

Some mergers can also affect infrastructure sharing. For example, in the proposed H3G/O2 transaction in the UK, the European Commission and the European General Court assessed the merger's impact on investment by examining its effects on two existing NSAs involving the merging parties.[37]

How 5G and Other Technological Changes Might Affect the Assessment of Infrastructure Sharing

The development of 5G and associated technological changes, such as the increasing role of software and the virtualization of mobile networks, has the potential to affect how regulators assess the competition effects of mobile infrastructure sharing.

"Softwarization" and "virtualization" are two ways of making 5G networks more flexible.[38] Softwarization is the concept whereby the functionality and performance of the network is determined by the software that runs the network instead of the underlying hardware (in this sense, the hardware and software are decoupled and the underlying hardware becomes commoditized). This allows networks to be enhanced and/or reconfigured to support different potential use cases, without upgrading or changing the underlying hardware.

Virtualization is a complementary technology that allows for virtual networks to operate on top of the physical network. This reduces the importance of radio equipment hardware (which becomes more standardized and interchangeable), while service differentiation is provided at the software level. This would mean that operators could share a physical network, with each operating their own virtual network that they control on top of that physical network.

Another example of technological change is the Open RAN project.[39] This project aims to move away from a RAN based on proprietary and integrated hardware and software from a single vendor, towards a RAN with open and interoperable interfaces between hardware and software. This would allow operators to use software and equipment from different vendors. In the present context, if the RAN becomes commoditized, then there are fewer competitive downsides from sharing it.

As a result of these developments associated with 5G, the concerns outlined above about an inability for MNOs to differentiate their services in the context of active NSAs may be reduced. This is because under 5G, service characteristics and quality are likely to be determined more by software and the core network (which typically sits outside of NSAs) than the radio equipment installed at towers.[40] Network slicing will also allow multiple virtual networks to operate over a single physical network.[41] Therefore, under 5G, parties to an NSA are likely to have more freedom to differentiate their products than would have been the case under previous generations of network technology.

At the European Union level, BEREC set out in 2019 its thinking on mobile infrastructure sharing, including the factors that EU national regulatory authorities should consider when assessing NSAs, in its Common Position, which recommends assessment of NSAs on a case-by-case basis.[42] In December 2020, BEREC held a workshop on mobile infrastructure sharing with stakeholders to discuss the future evolution of its Common Position, including issues relating to 5G roll out and the challenges and opportunities associated with 5G infrastructure sharing.[43]

Many stakeholders were positive about the flexibility and differentiation opportunities that software and virtualization of mobile networks will offer operators.[44] For example, one stakeholder argued that the distinction between passive and active network sharing becomes less relevant with virtualization, as differentiation is enabled by software, meaning active sharing becomes less problematic; therefore, it would be better to focus on the distinction between hardware and software in assessing NSAs.[45]

While BEREC concluded that its Common Position remains appropriate and does not need to be adapted at this stage, it acknowledged the information stakeholders provided on how software and virtualization with 5G could change views about the level of infrastructure-based competition that should be maintained and the balance between service-based and infrastructure-based competition.[46]

Conclusion

Both mergers and NSAs between MNOs have the potential to benefit consumers through increased investment and the dynamic competition benefits they bring. In particular, by improving the economics of 5G investment, they may increase the magnitude of investment and the speed with which 5G is rolled out. However, they may also reduce competitive tension, particularly in a more static sense, between MNOs. The overall effect on investment and consumer welfare (i.e., prices and quality) will depend on the specific facts and circumstances of each case.

The cases we have discussed highlight that for both mergers and NSAs, there are certain factors that will determine whether there is a positive impact on investment, including (among other things):

- The merging or sharing parties' financial position and ability to invest, and
- The extent of the synergies created by combining spectrum and network assets.

Given the substantial investment costs associated with 5G, and the resulting pressures on MNOs to collaborate, active NSAs are likely to play an increasingly important role in MNO plans for rolling out 5G networks. This is likely to attract greater regulatory scrutiny given the potential competition concerns raised by these types of NSAs.

Counterbalancing this, the technical characteristics of 5G (e.g., virtualization and network slicing) and other technological developments may lessen concerns that NSAs will limit the ability of MNOs to differentiate their services. The increasing role of software under 5G as the enabler of service

differentiation and the layer on which operators compete is likely to change the way mobile infrastructure sharing and consolidation is assessed in future. As in any dynamic and fast-moving technology-based industry, competition analysis should therefore not stand still and should be expected to adapt as the industry is disrupted and reshaped by new technology.

Economic analysis and evidence have an important role to play in evaluating the trade-off between efficiency gains and anticompetitive effects arising from concentration and cooperation between MNOs, and assessing the overall impact on investment and competition. ■

[1] Int'l Telecomms. Union, Recommendation ITU-R M.2083-0 (Sept. 2015), https://www.itu.int/dms_pubrec/itu-r/rec/m/R-REC-M.2083-0-201509-I!!PDF-E.pdf.

[2] *4G vs 5G: What's the Difference?,* EE (Sept. 4, 2020), https://shop.ee.co.uk/features-and-articles/4g-vs-5g-whats-the-difference.

[3] The C-Band refers to 3.5GHz spectrum, which is expected to be the key international band for initial 5G roll outs.

[4] Ferry Grijpink, Alexandre Ménard, Halldor Sigurdsson & Nemanja Vucevic, McKinsey & Co., *The Road to 5G: The Inevitable Growth of Infrastructure Cost* (Feb. 23, 2018), https://www.mckinsey.com/industries/technology-media-and-telecommunications/our-insights/the-road-to-5g-the-inevitable-growth-of-infrastructure-cost.

[5] *Id.* at 5.

[6] CTIA, Topline Results of 2018 CTIA Wireless Industry Survey (2019).

[7] *Id.*

[8] ARPU can fall either because consumers purchase lower-priced, lower-quality plans, or because prices for a given level of quality fall.

[9] For example, AT&T in the U.S. reports that "[m]obile data volume has slightly decreased during COVID-19 since people are able to connect to their home Wi-Fi throughout the day." Scott Mair, *6 Months In: Unyielding Connections in the Age of COVID-19*, AT&T, Technology Blog (Sept. 16, 2020), https://about.att.com/innovationblog/2020/09/fn_covid_19_six_months.html.

[10] Telecom Italia reported a traffic increase of 10 percent on its mobile network in the space of 2 weeks. Similarly, the 5 largest operators in Spain reported a 40 percent increase in overall IP traffic, a 25 percent increase in mobile traffic, and a 50 percent increase in mobile voice traffic since the start of the outbreak. *See* Rupert Wood, Analysys Mason, *COVID-19: Operators Should Be Concerned About the Robustness of Networks Rather than Capacity* (Mar. 23, 2020), https://www.analysysmason.com/research/content/comments/covid19-robustness-networks-rdnt0/.

[11] Since 2012, the European Commission has cleared 5 four-to-three mergers in the mobile sector (the first 4 subject to conditions and the latest unconditionally): (1) Case COMP/M.6497—Hutchison 3G Austria/Orange Austria, Comm'n Decision (Dec. 12, 2012), https://ec.europa.eu/competition/mergers/cases/decisions/m6497_20121212_20600_3210969_EN.pdf; (2) Case COMP/M.6992—Hutchison 3G UK/Telefónica Ireland, Comm'n Decision (May 28, 2014), https://ec.europa.eu/competition/mergers/cases/decisions/m6992_20140528_20600_4004267_EN.pdf; (3) Case M.7018—Telefónica Deutschland/E-Plus, Comm'n Decision (July 2, 2014), https://ec.europa.eu/competition/mergers/cases/decisions/m7018_6053_3.pdf; (4) Case M.7758—Hutchison 3G Italy/WIND/JV Comm'n Decision (Sept. 1, 2016), https://ec.europa.eu/competition/mergers/cases/decisions/m7758_2937_3.pdf; and (5) Case M.8792—T-Mobile NL/Tele2 NL, Comm'n Decision (Nov. 27, 2018), https://ec.europa.eu/competition/mergers/cases/decisions/m8792_3403_11.pdf. However, over the same period, the Commission prohibited the proposed four-to-three merger between Hutchison 3G UK (Three) and Telefónica UK (O2) in the UK in 2016 (subsequently overturned by the General Court in a May 2020 judgment, which the Commission said it would appeal to the European Court of Justice) and the proposed merger between TeliaSonera and Telenor's respective business units in Denmark was abandoned in 2015 after the parties were not able to fully address the Commission's competition concerns. *See* Case M.7612—Hutchison 3G UK/Telefónica UK, Comm'n Decision (May 11, 2016), https://ec.europa.eu/competition/mergers/cases/decisions/m7612_6555_3.pdf; Case T-399/16, CK Telecoms UK Invs. v. Comm'n, ECLI:EU:T:2020:217 (GC May 28, 2020); Case M.7419—TeliaSonera/Telenor/JV, 2015 O.J. (C 316) 1 (withdrawal of notification).

[12] Press Release, Eur. Comm'n, Antitrust: Commission Sends Statement of Objections to O2 CZ, CETIN and T-Mobile CZ for Their Network Sharing Agreement (Aug. 7, 2019) (IP/19/5110), https://ec.europa.eu/commission/presscorner/detail/en/IP_19_5110. NERA has advised T-Mobile CZ in this matter but the authors are not involved in that engagement.

[13] *See, e.g.*, Christos Genakos, Tommaso M. Valletti & Frank Verboven, *Evaluating Market Consolidation in Mobile Communications*, 33 Economic Pol'y 45 (Jan. 2018). The authors studied the dual relationship between market structure and prices and between market structure and investment in mobile markets, using a uniquely constructed panel of MNOs' prices and accounting information across 33 OECD countries between 2002 and 2014. The authors found that more concentrated markets lead to higher end-user prices and to higher investment per mobile operator, though the impact on total industry investment is not conclusive. The GSM Association (GSMA)—a global organization that represents MNOs' interests—has also published several papers assessing the impact of MNO consolidation on mobile market performance. *See, e.g.*, Serafino Abate, Pau Castells, Kalvin Bahia & Mayuran Sivakumaran, GSMA, *Mobile Market Structure and Performance in Europe, Lessons from the 4G Era* (Feb. 2020). The authors examined how European mobile markets performed during the 4G era, including how different market structures affected network quality, coverage and investment. The GSMA analysed 29 European countries between 2011 and 2018 and found that markets with more concentrated structures were able to deploy 4G more quickly and were better at delivering higher performances, driven by operators' more efficient use of investments and resources (including scarce resources such as spectrum and sites). The UK Office of Communications (Ofcom) examined empirical evidence on the relationship between market structure, investment and quality in European mobile markets. *See* Ofcom, *Market Structure, Investment and Quality in the Mobile Industry* (Dec. 22, 2020). Ofcom also conducted its own empirical analysis and found no evidence that mobile consolidation had a positive impact on investment or network quality (based on average 4G download speeds). Ofcom noted that its analysis did not assess the overall consumer impact of changes in market concentration, which would (at a minimum) need to take into account any impact on prices, as well as other dimensions of quality that are important to consumers.

[14] *See* Body of European Regulators for Electronic Communications (BEREC), BEREC Common Position on Mobile Infrastructure Sharing 9 (June 13, 2019) [hereinafter BEREC Common Position]. National regulatory authorities indicated that active sharing (which typically includes passive sharing) can achieve greater cost savings than passive sharing. In a separate BEREC report, some national regulatory authorities provided data on cost savings by type of sharing. BEREC, *BEREC Report on Infrastructure Sharing* 16 (June 14, 2018).

[15] *Infrastructure Sharing: An Overview*, GSMA (June 18, 2019), https://www.gsma.com/futurenetworks/wiki/infrastructure-sharing-an-overview/.

[16] Frank P. Maier-Rigaud, Marc Ivaldi & C-Philipp Heller, Cooperation Among Competitors: Network Sharing Can Increase Consumer Welfare 8–9 (2020), https://papers.ssrn.com/abstract=3571354.

[17] BEREC Common Position, *supra* note 14, at 9.

[18] Vodafone Hutchison Australia Pty Ltd. v Australian Competition and Consumer Comm'n [2020] FCA 117, ¶ 893 (Austl.) [hereinafter Vodafone].

[19] Maier-Rigaud et al., *supra* note 16, at 11.

[20] *Id.* at 9.

[21] Grijpink et al., *supra* note 4.

[22] Press Release, U.S. Dep't of Justice, Justice Department Settles with T-Mobile and Sprint in Their Proposed Merger by Requiring a Package of Divestitures

to Dish (July 26, 2019), https://www.justice.gov/opa/pr/justice-department-settles-t-mobile-and-sprint-their-proposed-merger-requiring-package. *See* New York v. Deutsche Telekom AG, 439 F. Supp. 3d 179 (S.D.N.Y. 2020).

[23] Press Release, Australian Competition & Consumer Comm'n, ACCC Opposes TPG VHA Merger (May 8, 2019), www.accc.gov.au/media-release/accc-opposes-tpg-vha-merger.

[24] *See* Vodafone, [2020] FCA 117.

[25] *See id.* ¶¶ 471 & 897. There is a nuance in VHA/TPG, in that one of the parties' arguments was that TPG was not actually going to roll out a full mobile network, given its investment plans had been disrupted by the government's decision to ban Huawei from supplying equipment to Australia's 5G networks. The Federal Court of Australia accepted this argument, noting: "The existing fact is that TPG has no business case for rolling out a mobile network, and has indicated it will not do so absent the merger."

[26] The VHA/TPG decision states that "MergeCo will benefit financially from achieving scale. Scale is important for MNOs, as it enables the fixed costs of providing coverage to be recovered across a larger number of customers." *Id.* ¶ 844. Related to these cost savings, the decision states, "Further, I do not consider that MergeCo would use its net profit after tax to pay dividends to its shareholders or to pay down debt, at the expense of using its financial firepower to invest in its network or compete for market share." *Id*. ¶ 849.

[27] The judge stated, "[I]t seems Vodafone faces financial difficulties that are unlikely to materially change absent the merger, and those financial difficulties will limit the extent to which Vodafone can invest in, and grow its business, in the counterfactual." *Id*. ¶ 677.

[28] *See id.* ¶¶ 829–853. In relation to an improved balance sheet, the judge stated "MergeCo would have a stronger balance sheet than either TPG or Vodafone separately. This would provide MergeCo with the capacity to invest strongly in its mobile assets, including by raising equity capital if necessary, and to roll-out 5G services and reduce network congestion more quickly." *Id.* ¶ 829.

[29] *Id.* ¶ 854.

[30] *Deutsche Telekom*, 439 F. Supp. 3d at 199.

[31] The "weakened competitor" defense is the argument that a merging party will not be able to compete effectively on its own in the future, and therefore, the merger is less likely to have an anti-competitive effect. *See id.* at 218.

[32] *Id*.

[33] The court stated:

> The undisputed evidence at trial reflects that combining Sprint and T-Mobile's low-band and mid-band spectrum on one network will not merely result in the sum of Sprint and T-Mobile's standalone capacities, but will instead multiply the combined network's capacity because of a technological innovation referred to as 'carrier aggregation' and certain physical properties governing the interaction of radios.

Id. at 208.

[34] *Id.* at 210.

[35] *Id.* at 209 ("Apart from capacity and cost benefits, Defendants claim that New T-Mobile will provide better coverage than Sprint customers currently receive because T-Mobile's low-band spectrum covers a broader range and penetrates through buildings more effectively than Sprint's mid-band holdings can. Having a broad range of spectrum would allow New T-Mobile to dedicate each band of spectrum to its best use; it could prioritize the use of low-band in areas that mid-band and mmWave could not reach, while instead prioritizing the other two bands in areas correspondingly closer to the cell sites.").

[36] Vodafone, [2020] FCA 117, ¶ 704.

[37] *See* Case COMP/M.6992—Hutchison 3G UK/Telefónica Ireland, Comm'n Decision, § 8.2.2 (May 28, 2014), https://ec.europa.eu/competition/mergers/cases/decisions/m7612_6555_3.pdf, Case T-399/16, CK Telecoms UK Invs. v. Comm'n, ECLI:EU:T:2020:217, ¶ 292–418 (GC May 28, 2020), https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX-:62016TJ0399. For an overview of the assessment of the merger's impact on investment, see, e.g., Will Taylor & Adrien Cervera-Jackson, *Competition Implications of the Transition to 5G*, 16 Competition L. Int'l 109 (2020).

[38] *See* GSMA, *Road to 5G: Introduction and Migration* 16 (2018); Massimo Condoluci & Toktam Mahmoodi, *Softwarization and Virtualization in 5G Mobile Networks: Benefits, Trends and Challenges,* 146 Computer Networks 65, 66 (2018).

[39] *See, e.g., Open RAN Explained,* Ericsson, https://www.ericsson.com/en/openness-innovation/open-ran-explained; *Open RAN Explained*, Nokia (Oct. 16, 2020), https://www.nokia.com/about-us/newsroom/articles/open-ran-explained/; BT, *Emerging Technologies and their Potential Impact on the Communications Industry*: BT Response 16 (Jan. 5, 2021).

[40] *See* GSMA, *supra* note 38, at 16; Condoluci, *supra* note 38, at 65.

[41] This will allow MNOs using the same network to define different virtual networks with different quality characteristics targeted at different use cases and customers. For an overview of network slicing, see GSMA, *An Introduction to Network Slicing* (2017).

[42] BEREC Common Position, *supra* note 14.

[43] BEREC, Summary Report on the Outcomes of Mobile Infrastructure Sharing Workshop 2 (Dec. 18, 2020).

[44] *Id.* at 17.

[45] *Id.* at 13.

[46] *Id.* at 2–3.