

# Competition dynamics in mobile markets

An assessment of the effects  
on network investment and  
quality in Europe



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# Executive summary

## Comparing ambitions with reality

The mobile telecommunications market in Europe is undergoing a significant phase of investment in 5G networks. As articulated in the European Commission's 5G Action Plan<sup>1</sup> and the EU Digital Decade,<sup>2</sup> the key objective is uninterrupted 5G broadband coverage for all urban areas and major roads and railways by 2025, and for all populated areas to be covered with 5G by 2030.

Despite its ambitions, Europe has lagged behind its economic peers when it comes to the adoption and deployment of 5G. There is also evidence that the majority of European countries are lagging behind in terms of the quality of existing networks. Such slow progress can have significant implications for consumers and the wider economy, particularly considering the growing demand for networks with higher capacity and higher performance.

## Creating the right market conditions

An important question is whether market conditions sufficiently incentivise the investments needed to achieve Europe's 5G targets and offer advanced 5G services. Competition dynamics are a key element. Compared to international benchmarks and Europe's three-player markets, four-player markets in Europe have been characterised by lower concentration levels and profit margins over the last decade. From 2015, four-player markets in Europe also experienced lower investment levels compared to three-player markets, and did not improve service quality (download speeds, upload speeds, latencies) to the same degree as three-player markets in Europe. This marked the time when operator investments became focused on capacity (with 4G networks mostly rolled out) and data revenues exceeded voice revenues. Given that technical progress and dynamic efficiencies are stronger for data than for voice, this may have allowed operators in three-player markets to improve network quality more than in four-player markets.

The trends could also be partly linked to competition policy actions in Europe. Between 2011 and 2014, mobile mergers were approved in Austria, Ireland and Germany on the basis of a set of remedies, which included divestment of spectrum and commitments to provide wholesale network access to new and existing MVNOs. However, from 2015 onwards, the European Commission's stance on consolidation cases hardened, including the decision to impose the introduction of a new entrant as a pre-condition to approving a merger in Italy in 2016, and its subsequent decision to block a merger in the UK. This may have signalled to market players (intentionally or otherwise) that further consolidation in other markets would face procedural challenges during merger reviews. With dynamic competition conditions unlikely to change, this may have triggered an adjustment in capex decisions in four-player markets. Coupled with strong growth of mobile data traffic in most markets, network congestion affected speeds and latencies to a greater extent in four-player markets from late 2015.

<sup>1</sup> See <https://digital-strategy.ec.europa.eu/en/policies/5g-action-plan>

<sup>2</sup> See <https://digital-strategy.ec.europa.eu/en/policies/5g-digital-decade>

## The link between competition and investment

While descriptive statistics are suggestive, they do not show whether these trends are causally linked. In a recent economic [research paper](#), the GSMA studied how competition dynamics in Europe affected investment and mobile network performance during 2011-2021. Overall, the results indicate that the trends observed in competition and investment can be partly explained by dynamic competition effects. The link between lower concentration and profit margins and reduced investment per operator is statistically significant and robust across a range of alternative methods and checks.

The econometric analysis also confirms there is no statistically significant relationship between market structure and consumer prices. Indeed, during the 2011-2021 period, prices declined significantly in both three- and four-player markets and did not materially differ between the two, which underlines the importance of technological progress and dynamic effects in driving price reductions in the mobile sector. Improving dynamic competition conditions would therefore likely result in greater investment that can yield better services (in terms of faster speeds and greater network coverage) and innovation for European consumers in those markets.

## Re-evaluating approaches to competition policy

Economic theory predicts these observed trends when dynamic competition effects are significantly stronger than static competition effects. In technology-intensive sectors, such as mobile markets, it is plausible that relatively more concentrated markets better support incentives to invest, differentiate and improve products, and innovate, to the benefit of consumers. The deployment of new generations of mobile technologies have been the main driver of price reductions, as new network technologies are able to deliver services at a fraction of the marginal cost of previous generations.

Improving dynamic competition conditions such as scale and incentives to earn a return would likely result in greater investment and better services for consumers. Policymakers should therefore carefully consider the full range of policy levers that can

generate the market outcomes desired in terms of investment, quality and prices. This includes a balanced consideration of the positive effects of mergers on dynamic competition incentives and investments. For example, regulatory remedies that artificially create entry do not necessarily strengthen the dynamic competition conditions that the evidence shows are needed to enhance welfare. Competition policy can cause significant efficiency losses, related to costs, network quality and deployment, by not giving the appropriate weight to the long-term effects of investment and innovation on consumer welfare. European policymakers should therefore re-evaluate their approach to competition policy, acknowledging the crucial role of investment in delivering consumer welfare and strengthening Europe's competitiveness in global markets.



# 01 5G in Europe



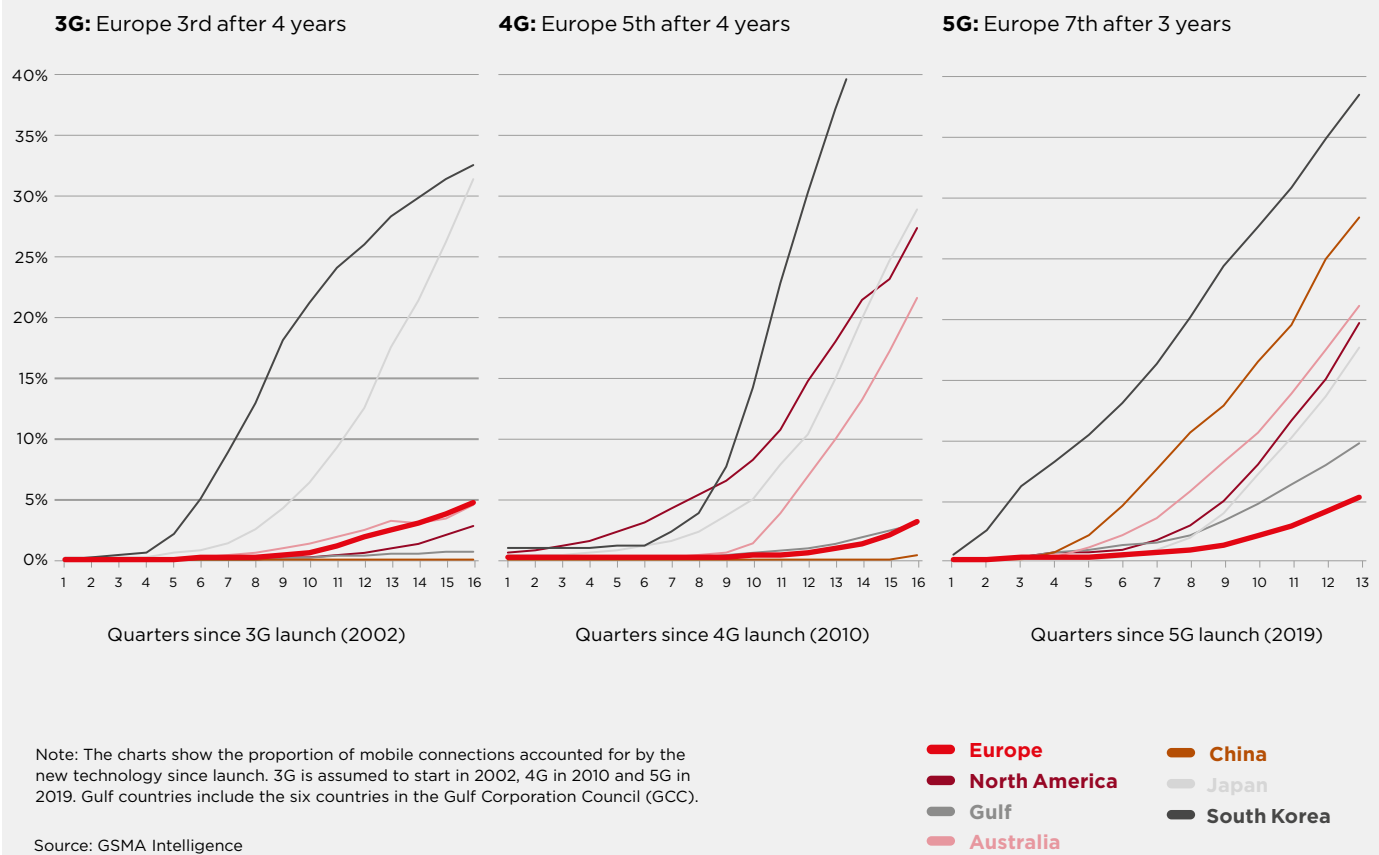
In January 2022, commercial 5G was available in all 27 EU Member States, as well as in the UK, Switzerland and Norway. As articulated in the EU Commission’s 5G Action Plan<sup>3</sup> and the EU Digital Decade,<sup>4</sup> the key objective is to achieve uninterrupted 5G broadband coverage for all urban areas and major roads and railways by 2025, and for all populated areas to be covered with 5G by 2030.

Unfortunately, when it comes to the adoption and deployment of new mobile network technologies, Europe has increasingly lagged behind its economic peers, as shown in Figure 1. The adoption of 3G in Europe in the first four years was either at a similar level to or higher than other developed economies, with the exceptions of South Korea and Japan. The

adoption of 4G in Europe followed a similar path, but other markets including North America and Australia saw much faster growth. Since 5G launched at the start of 2019, adoption across high-income countries has increased even faster than with previous technologies, but Europe has lagged further behind not only the ‘4G leaders’ but also China and countries in the Gulf, which have made determined efforts to drive 5G forward in their markets. A similar scenario has also emerged in terms of 5G network coverage. As of the end of 2021, around 67% of European citizens were covered by a 5G network compared to more than 90% in the US, Australia and South Korea, and almost 80% in the GCC states.

Figure 1  
**3G, 4G and 5G as a share of mobile connections since launch**

% of connections



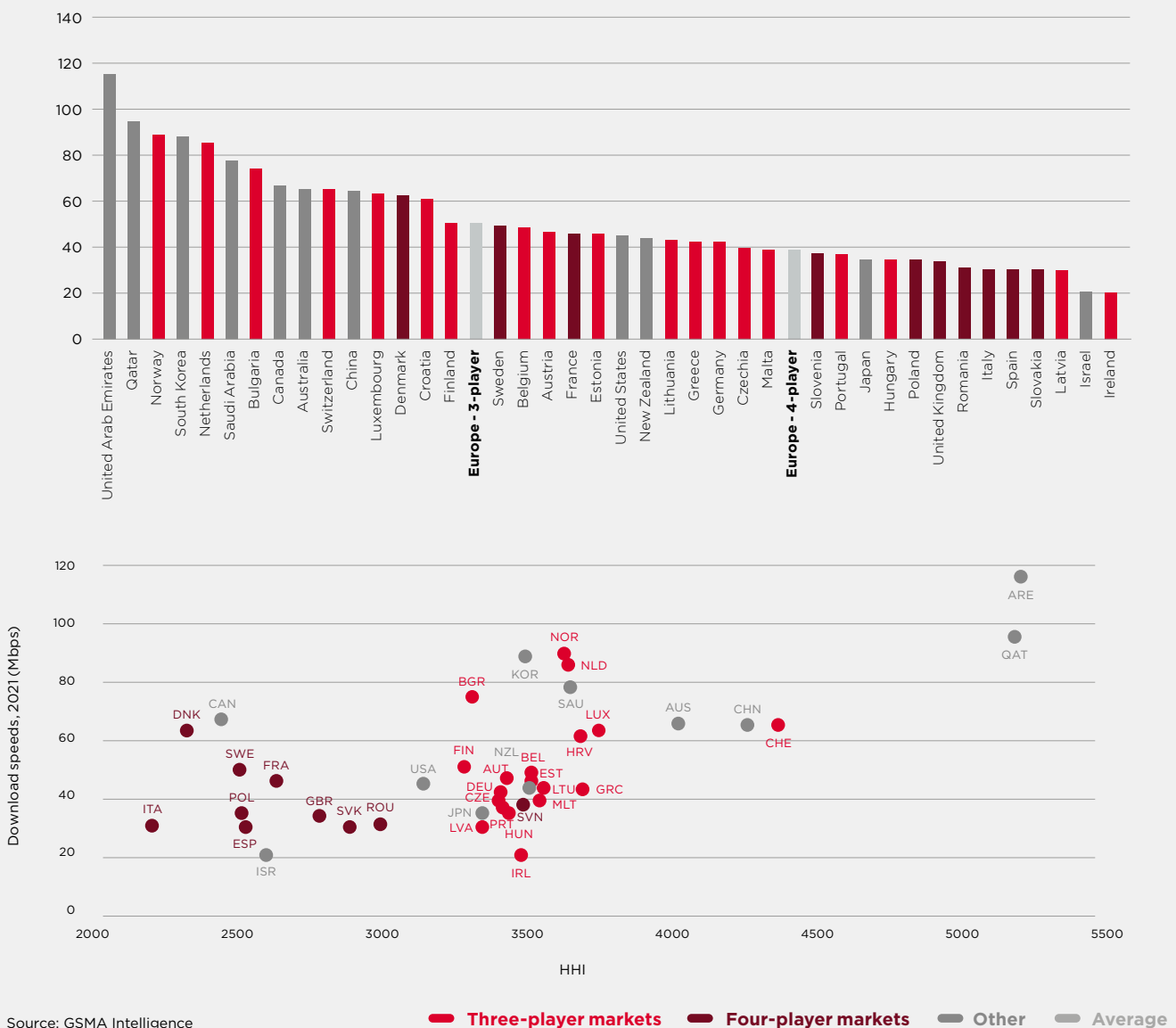
<sup>3</sup> See <https://digital-strategy.ec.europa.eu/en/policies/5g-action-plan>

<sup>4</sup> See <https://digital-strategy.ec.europa.eu/en/policies/5g-digital-decade>

While the deployment of new technologies is not a race, delays can have significant implications for consumers and the wider economy, particularly considering the growing demand for higher capacity networks. There is also evidence that the majority of European countries are lagging behind in terms of the quality of existing networks. Figure 2 presents average download speeds across European countries, other high-income countries and China. It shows that the majority of European countries have lower levels of network quality.

Looking at other high-income countries that have better quality networks than Europe, the majority are more concentrated, with either two or three large national players. Figure 2 shows that among the top 10 countries in Europe with the fastest speeds, eight are three-player markets, while the two that are four-player markets (Denmark and Sweden) each have two operators that share multi-operator core networks (MOCNs) and spectrum, meaning there is a greater level of network sharing than in most other four-player markets.<sup>5</sup>

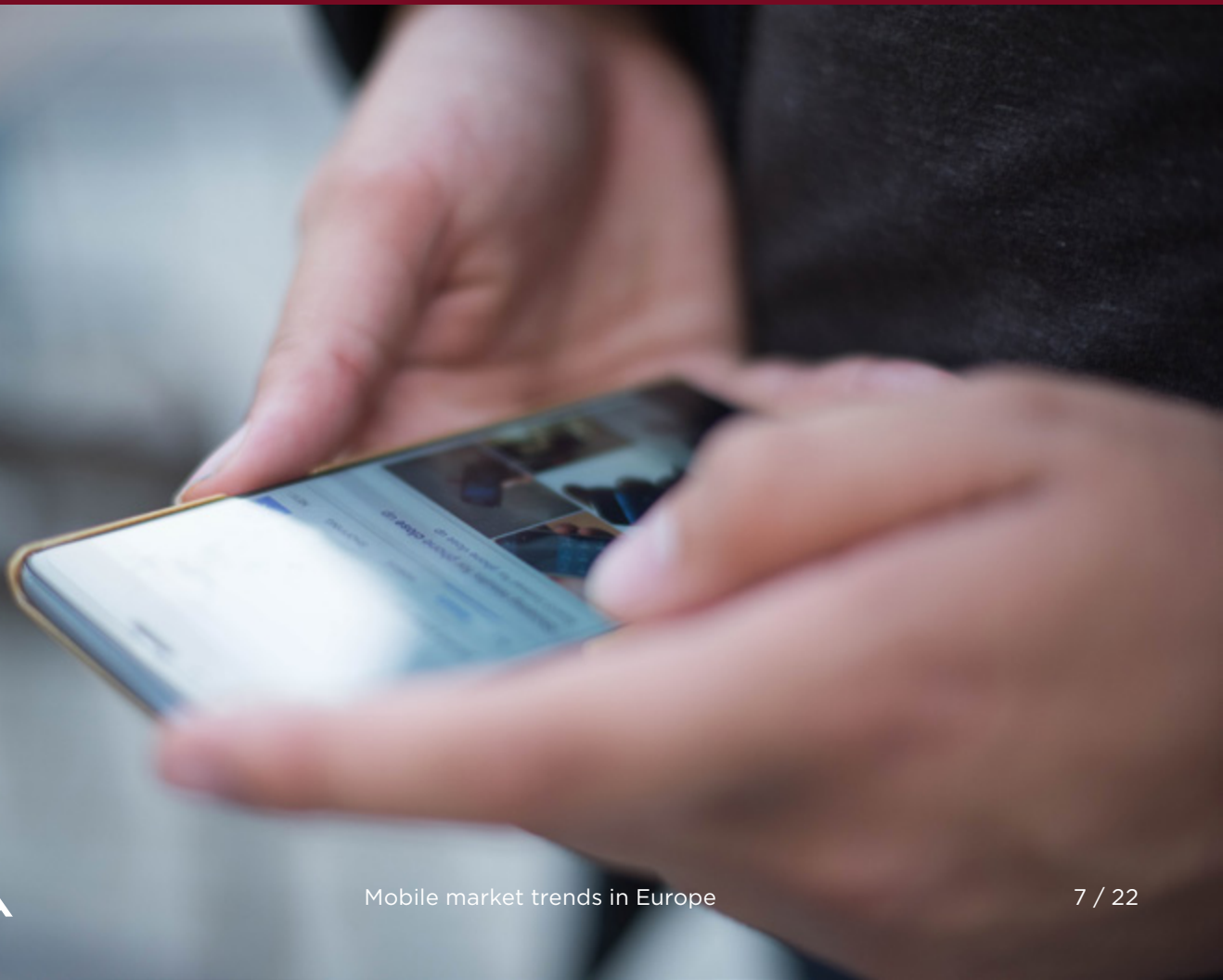
Figure 2  
Download speeds in Europe and other high-income countries, 2021



<sup>5</sup> By sharing more of the network (spectrum as well as passive and active site elements), there is greater scope for cost savings and investing in networks (as it is essentially a market with three rather than four networks).



# 02 Mobile market trends in Europe



# Since 2010, mobile operators have sought to reduce network costs and improve efficiency either by engaging in network sharing or through market consolidation in the form of mergers and acquisitions.

An important driver of 5G in Europe is whether market conditions generate the incentives and ability to make the investment necessary to achieve the 5G targets. The rollout of 5G will incur higher deployment costs than 4G. A report by the European Court of Auditors suggests that the total deployment cost of 5G across all EU member states could reach €400 billion. On the demand side, how much additional revenue operators will gain from 5G remains uncertain. While mobile internet use has increased exponentially over the past decade, and networks have had to manage the higher traffic volumes (expected to continue with 5G), operator revenues in most European countries have been relatively flat or have declined.

Investments in the mobile sector are influenced by competition and market structure. Both economic theory and empirical literature<sup>6</sup> have highlighted the important trade-off between competition and investment depending on market circumstances. On the one hand, mobile networks are characterised by large, common costs, meaning larger players with greater scale will drive more efficient investments. As a result, in more concentrated mobile markets, firms may have a greater incentive (as well as greater ability) because of the potential for higher returns. On the other hand, more players do not necessarily mean greater competition.

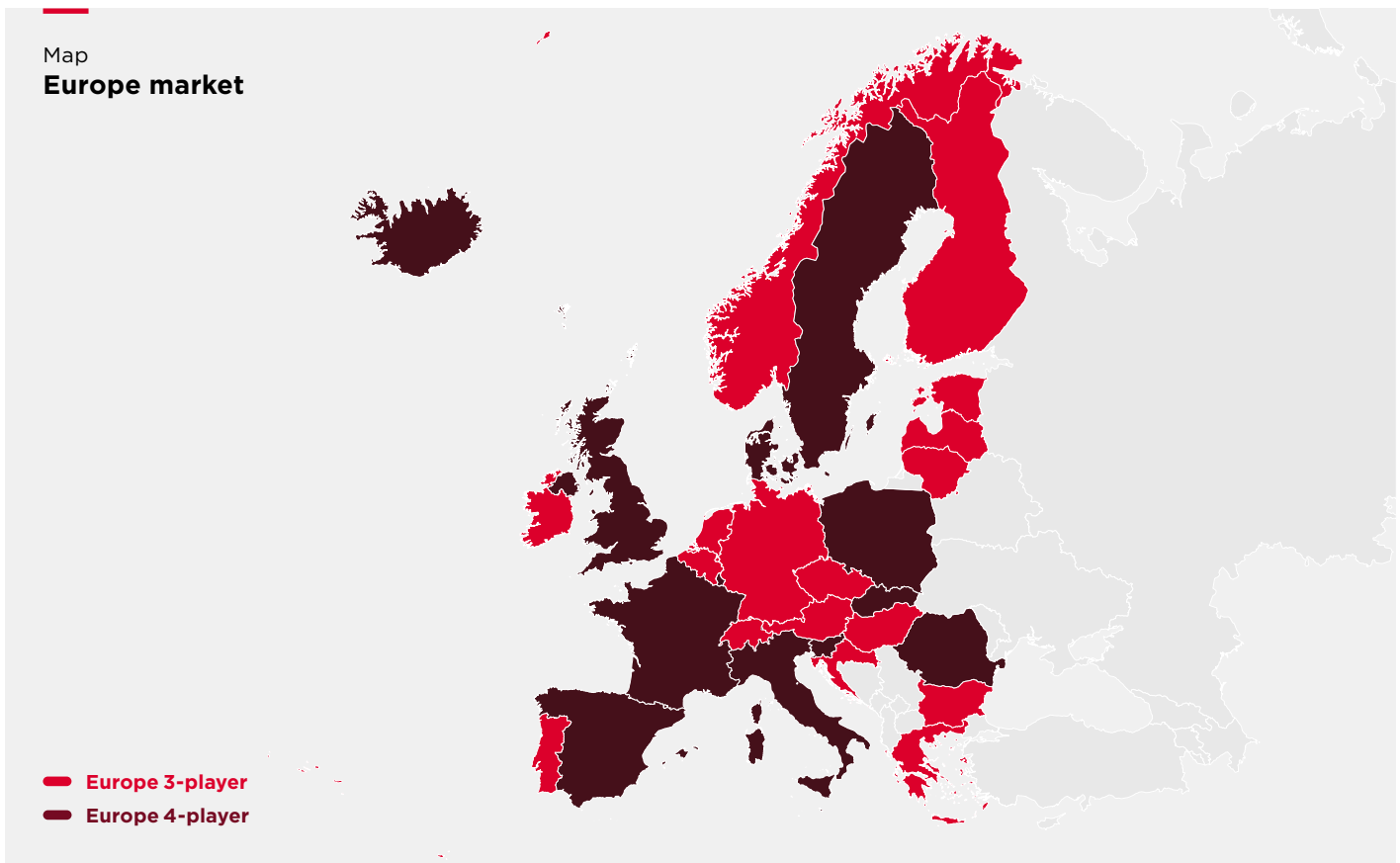
The competition dynamics that optimise investment in the mobile sector have been extensively debated in Europe over the past decade.

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<sup>6</sup> For a review of the relevant economics literature, see [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=4175243](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4175243)

There have been seven approved mergers in Europe since 2010<sup>7</sup> – in the UK, Austria, Ireland, Germany, Norway, Italy and the Netherlands. Over the same period, there have been four major entries into European mobile markets – in France, Netherlands, Italy and Slovakia. In the 2011–2014 period, mobile mergers in Europe were approved on the basis of a set of remedies, which typically included divestment of spectrum and commitments to provide wholesale network access to new and existing MVNOs. However, from 2015, the European Commission’s stance on consolidation cases generally hardened. First, a proposed merger was withdrawn in Denmark on the expectation that the European Commission would not clear it without significant remedies.<sup>8</sup> In August 2015, Three and Vimpelcom in Italy announced their intention to merge their operations in Italy; this was only allowed by the European Commission

in 2016 following a structural remedy that ensured the market entry of a new operator (Iliad). Europe’s chief competition authority, the Directorate General for Competition of the European Commission, also rejected a proposed merger in the UK in 2016 on the grounds that the competition concerns outweighed the perceived potential benefits.<sup>9</sup> The decision by the European Commission to block the Three/O2 merger in the UK was subsequently annulled by the EU General Court. The only significant European mobile merger approved since 2015 was in the Netherlands in 2019, with T-Mobile acquiring Tele2 (which had entered the market in 2015). However, some European operators have recently stressed the need for certain markets to consolidate in order to boost investment in the sector and accelerate the rollout of 5G, while Vodafone and Three entered into talks to merge UK operations in May 2022.



7 The data we study covers 29 European countries – 26 of the 27 members of the European Union plus the UK, Norway and Switzerland (Cyprus was not used due to the existence of two practical mobile markets on the island). We included operators that had a market share greater than 3% at some point in the period of analysis. This was for two reasons: to ensure that we only took into account operators with a significant presence in the national market; and to ensure that the operators in our sample had sufficient network quality data. The operators included in our analysis accounted for more than 99% of mobile connections in the 29 countries over the period.

8 "Statement by Commissioner Vestager on announcement by Telenor and TeliaSonera to withdraw from proposed merger", European Commission, September 2015

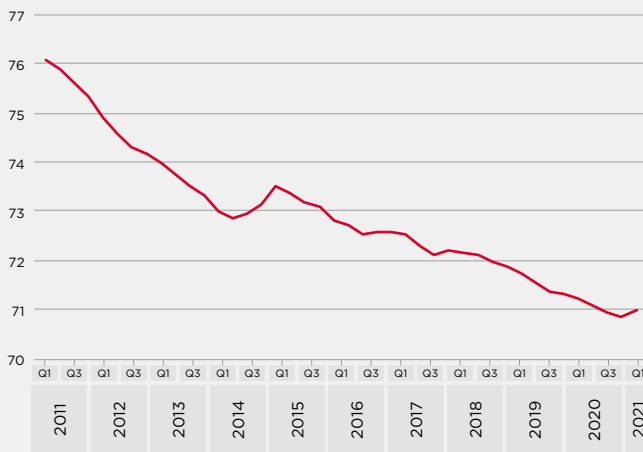
9 Case M.7612 – Hutchison 3G UK /Telefonica UK, European Commission – DG Competition, May 2016

During 2011–2021, European mobile markets experienced on average a decline in market concentration as measured by HHI<sup>10</sup> and C2.<sup>11</sup> In fact, in 2021, concentration levels in Europe stood significantly below the rest of the world, with HHI values of 3250 compared to 4800 on average globally.<sup>12</sup> Furthermore, while from 2015 global levels

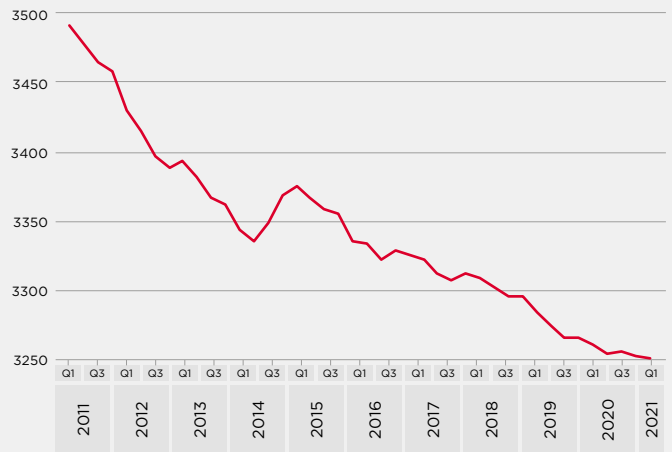
of market concentration in mobile markets remained stable, in Europe they continued to decline, meaning the gap became larger during the period of analysis. During this period, Europe also sustained a 500-point gap versus the higher HHI values observed in other high-income countries.

Figure 3  
Market concentration trends

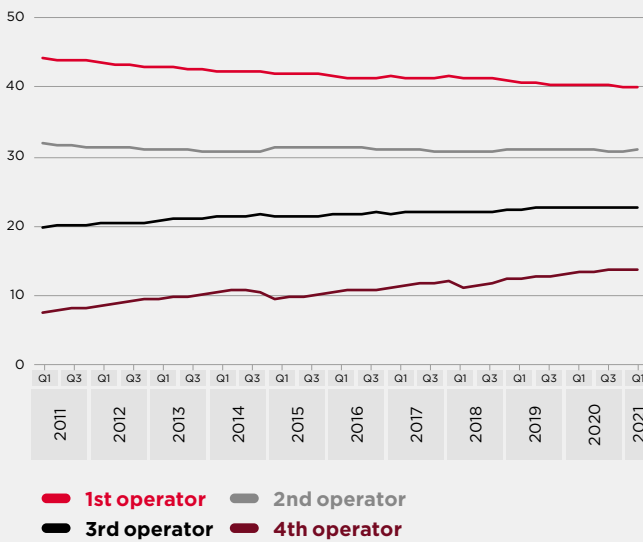
Average C2 in Europe since 2011



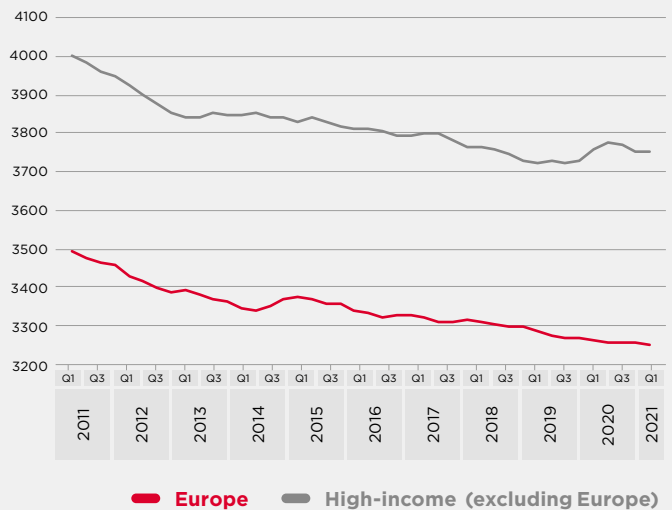
Average HHI in Europe since 2011



Market shares in Europe since 2011



Average HHI in Europe and other high income markets



Source: GSMA Intelligence

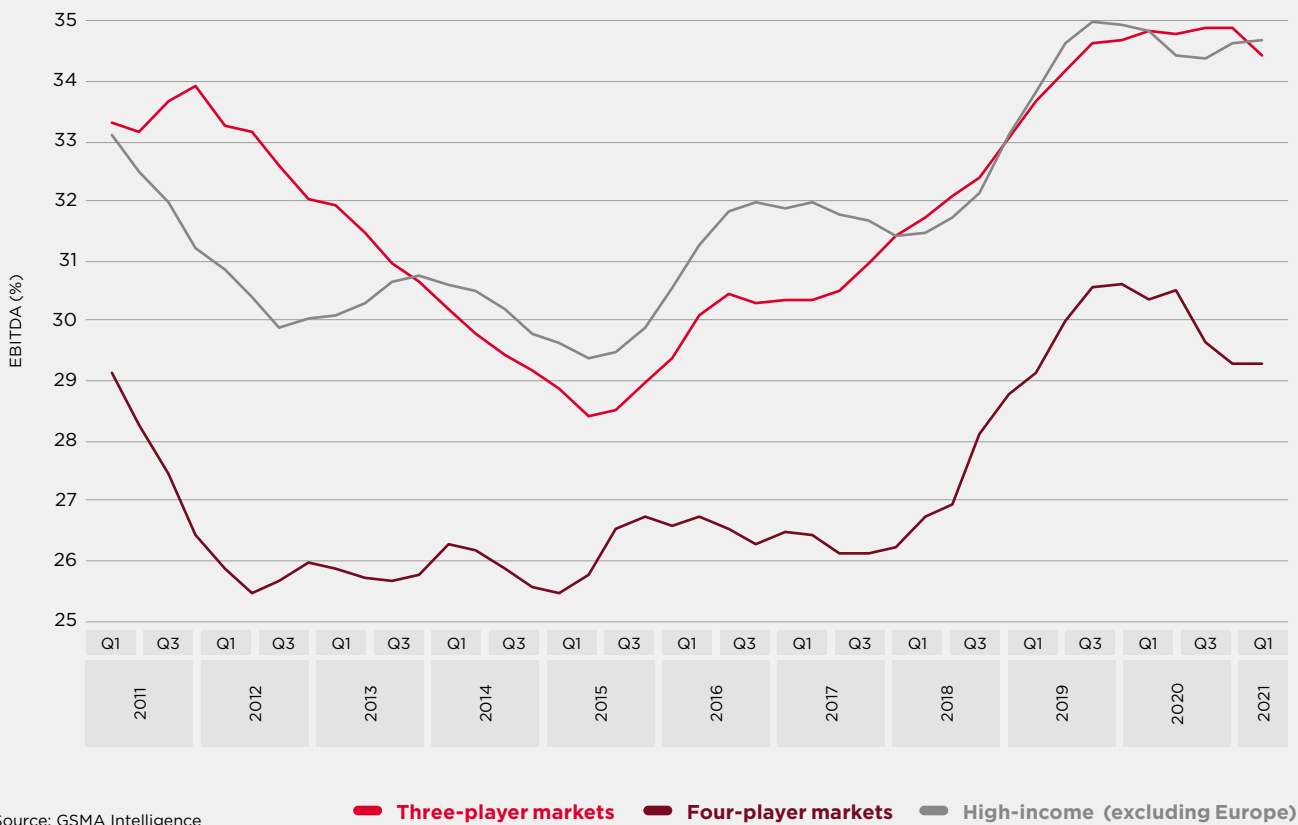
<sup>10</sup> The Herfindahl-Hirschman Index (HHI) is the primary measure of market concentration with values of 0–10,000 and increasing values suggesting a higher level of market concentration. The index is formed by summing the squares of individual operator market shares within each market. The functional form has the impact of skewing higher results to markets where individual operators have very high market shares. In this study, market shares are calculated based on the number of mobile connections of each operator in a country.

<sup>11</sup> The Concentration Ratio-2 (CR2) measures the market shares of the two largest firms in the market.

<sup>12</sup> Global HHI is based on the average HHI across all countries globally. Data is sourced from GSMA Intelligence.

Coupled with the reduction in market concentration, this period in Europe was characterised by profit margins remaining significantly below global levels. This was particularly the case in European four-player markets, with EBITDA margins in the period fluctuating between 25% and 30%, compared to an average of 30-35% in three-player markets and other high-income countries.

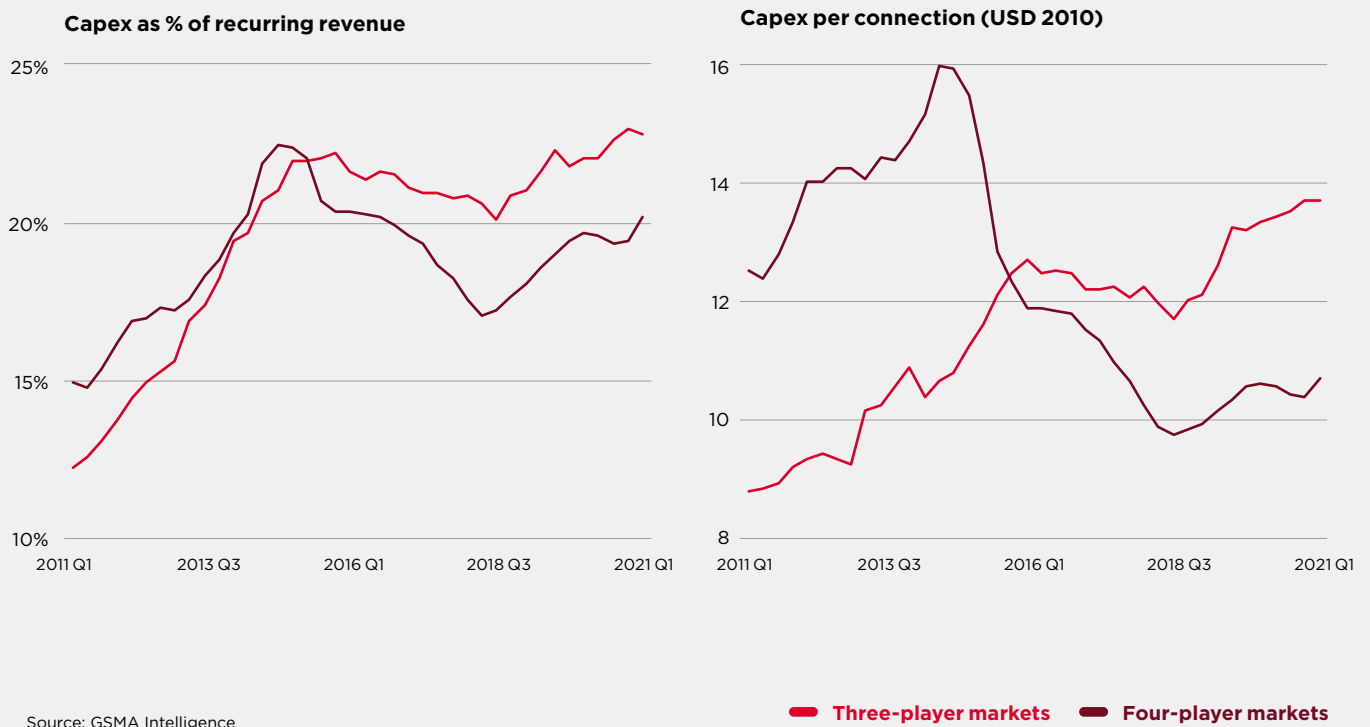
Figure 4  
EBITDA margins



In keeping with the theory of dynamic competition forces, higher market concentration and profit margins (and in particular the expectation of those continuing in the future) can be linked to greater investment. Capex trends at an operator level are consistent with this theory from 2015 onwards, with operators in European three-player markets investing more per connection and as a proportion of revenues.

Figure 5

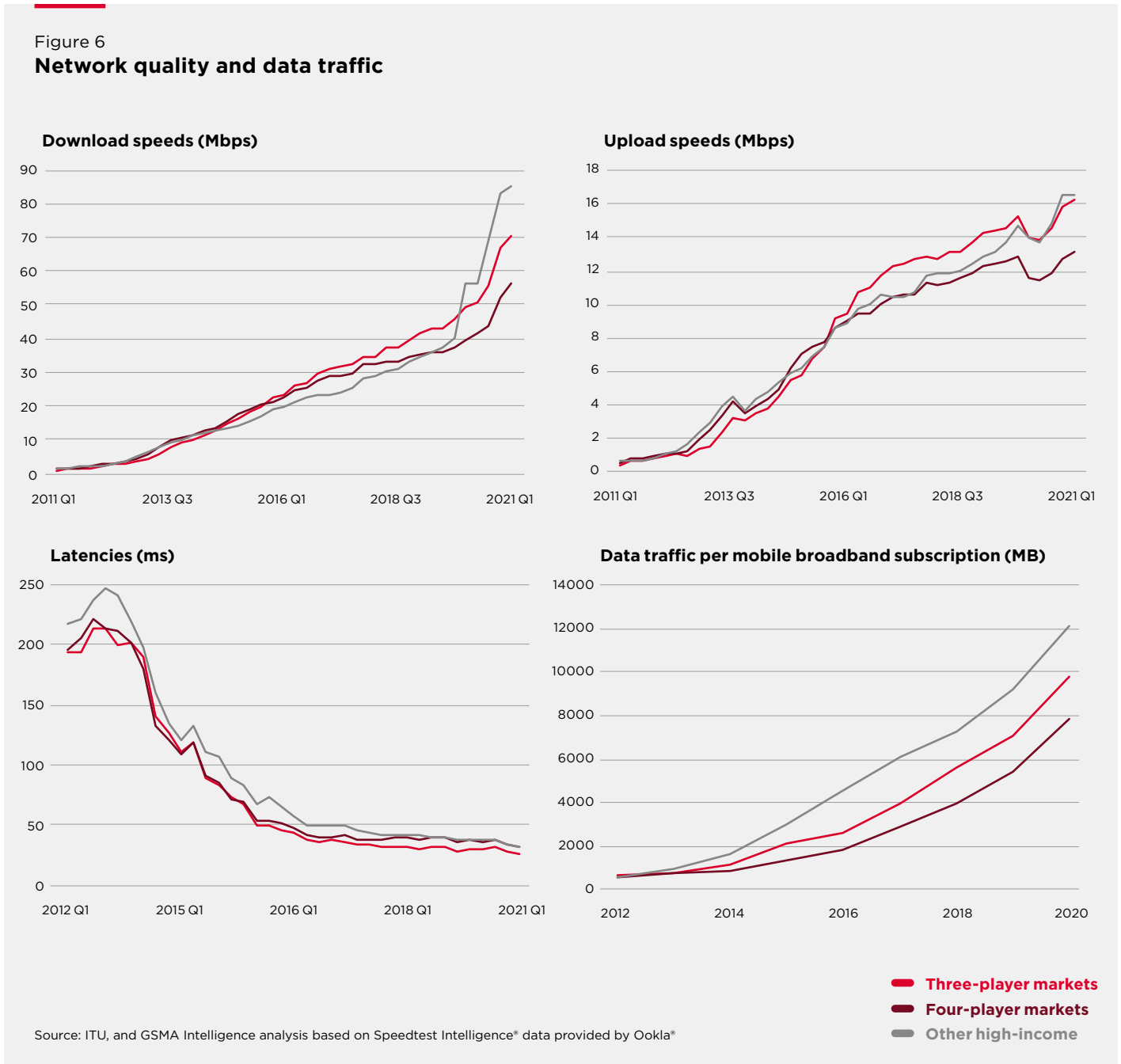
**Capex as a percentage of recurring revenue and Capex per connection**





Differences in dynamic competition conditions between markets can also result in different abilities and incentives to differentiate products and services versus competitors in a market – for example, by improving the quality of mobile service offerings. The fact that operators in three-player markets had

higher investment levels from 2015 may have meant they could have invested more quickly in additional capacity and in newer and faster technologies (such as LTE Advanced), delivering faster download and upload speeds as well as lower latencies in those markets (see Figure 6).<sup>13</sup>



13 Figure 6 shows a notable short-term drop in upload speeds in 2020, which was due to the increase in network usage and congestion caused by the Covid-19 pandemic.

# Both investments as a percentage of revenue and the main network quality trends show a distinct gap emerging between three- and four-player markets from late 2015.

At this point, the majority of operators in Europe had widely rolled out 4G networks (with an average of 80% population coverage), which meant that investments became focused on capacity. It was also when data revenues started to exceed voice revenues in Europe, as consumers intensified their use of mobile internet and application services.<sup>14</sup> Given that technical progress and dynamic efficiencies are stronger for data than voice, this may have allowed three-player markets to improve network quality more than four-player markets, particularly in combination with higher returns and operators having access to more spectrum in three-player markets.

Another relevant factor may have been the competition policy context. The European Commission's tougher stance on approving mobile mergers – demonstrated in the cases of Denmark, Italy and the UK – may have signalled to market players that further in-market consolidation would not be allowed.<sup>15</sup> The expectation that competition conditions in four-player markets were not likely to change may have triggered an adjustment to investment plans by operators in those markets, resulting in lower investment per operator. These reduced investments in network capacity, coupled with strong mobile traffic data growth, may have in turn led to network congestion (which can lead to lower speeds and higher latencies) having a greater impact in four-player markets from late 2015.

While dynamic competition forces are important, static competition effects (e.g. higher market power for individual players in more concentrated markets) could mean lower profit margins and market concentration are linked to lower retail prices for consumers. At the same time, in technology-intensive sectors such as mobile communications, dynamic competition forces can be the main driver of consumer price reductions, as new network technologies are able to deliver services at a fraction of the cost of previous generations. In that case, lower market concentration and profit margins can be linked to a reduced ability and incentive to invest, innovate and roll out new technologies and services. Consumer price effects therefore depend on which of the two effects dominates.

<sup>14</sup> Impact of mobile operator consolidation on unit prices, Telecommunications Policy, Volume 45 (4), 2021

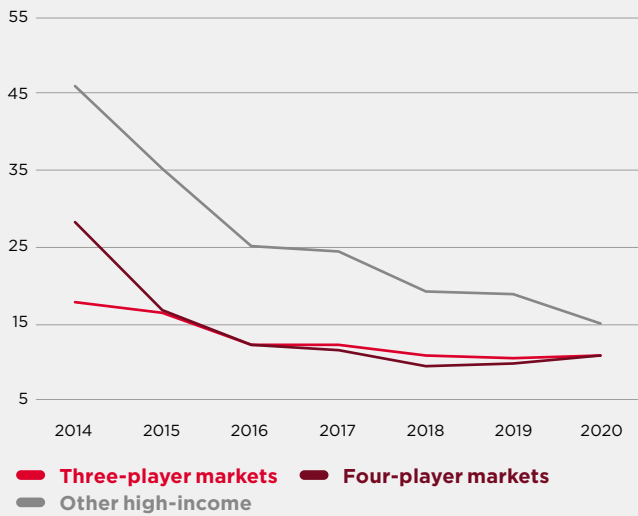
<sup>15</sup> See "Orange says European telecoms consolidation off for two years", FT, June 2016, and "Little chance of 4-to-3 merger in Swedish telecoms market: Telia", Reuters, November 2020

For 2011–2021, we analysed average (recurring) revenue per user (ARPU) as a proxy for consumer prices.<sup>16</sup> We also considered the price of 1 GB and 5 GB consumption baskets over the 2014–2020 period, where data was available at a country-level on an annual basis. All trends suggest a clear price reduction in all markets, which underlines the importance of dynamic effects in driving price reductions per user in mobile markets, especially for data. Average unit prices in Europe were seven times lower in 2019 than they were in 2011. Across all

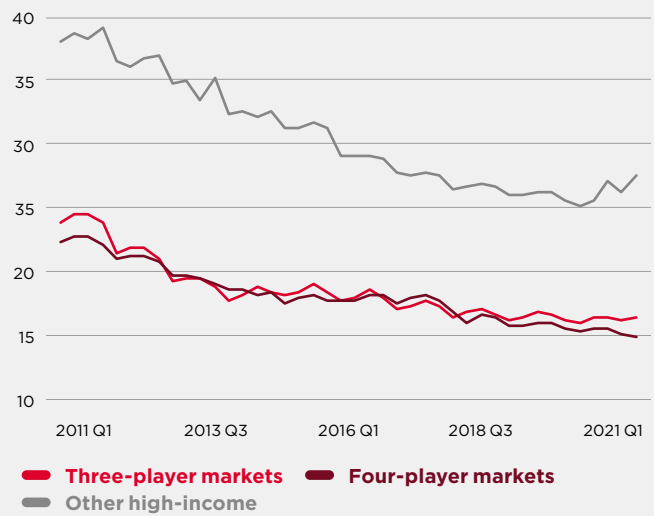
markets, prices per user or per basket also reduced significantly. However, there is no clear, discernible difference between three- and four-player markets. If static effects were strong, we would expect to see lower prices in four-player markets, which is not the case.

Figure 7  
Pricing trends

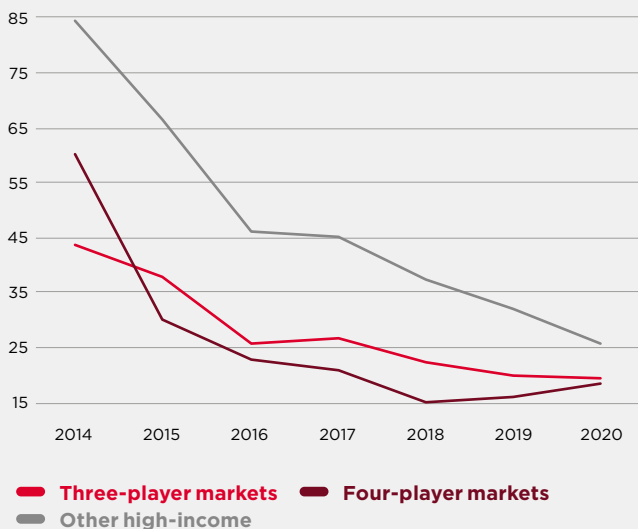
Price of 1GB basket (PPP)



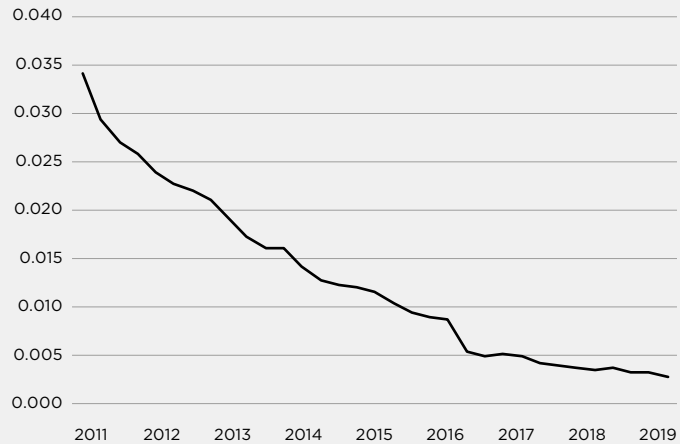
ARPU in Europe and high-income countries (PPP)



Price of 5GB basket (PPP)



Effective price per MB (USD) in Europe



Source: GSMA Intelligence, ITU

<sup>16</sup> It should be noted that ARPU figures have some limitations as they can also include other sources of revenue such as handsets and value-added services, and by reflecting average prices do not immediately changes to tariffs and plans offered by mobile operators to new customers.

In keeping with the theory of dynamic competition forces, higher market concentration and profit margins (and in particular the expectation of those continuing in the future) can be linked to greater investment.

# 03 Competition dynamics and 5G investments



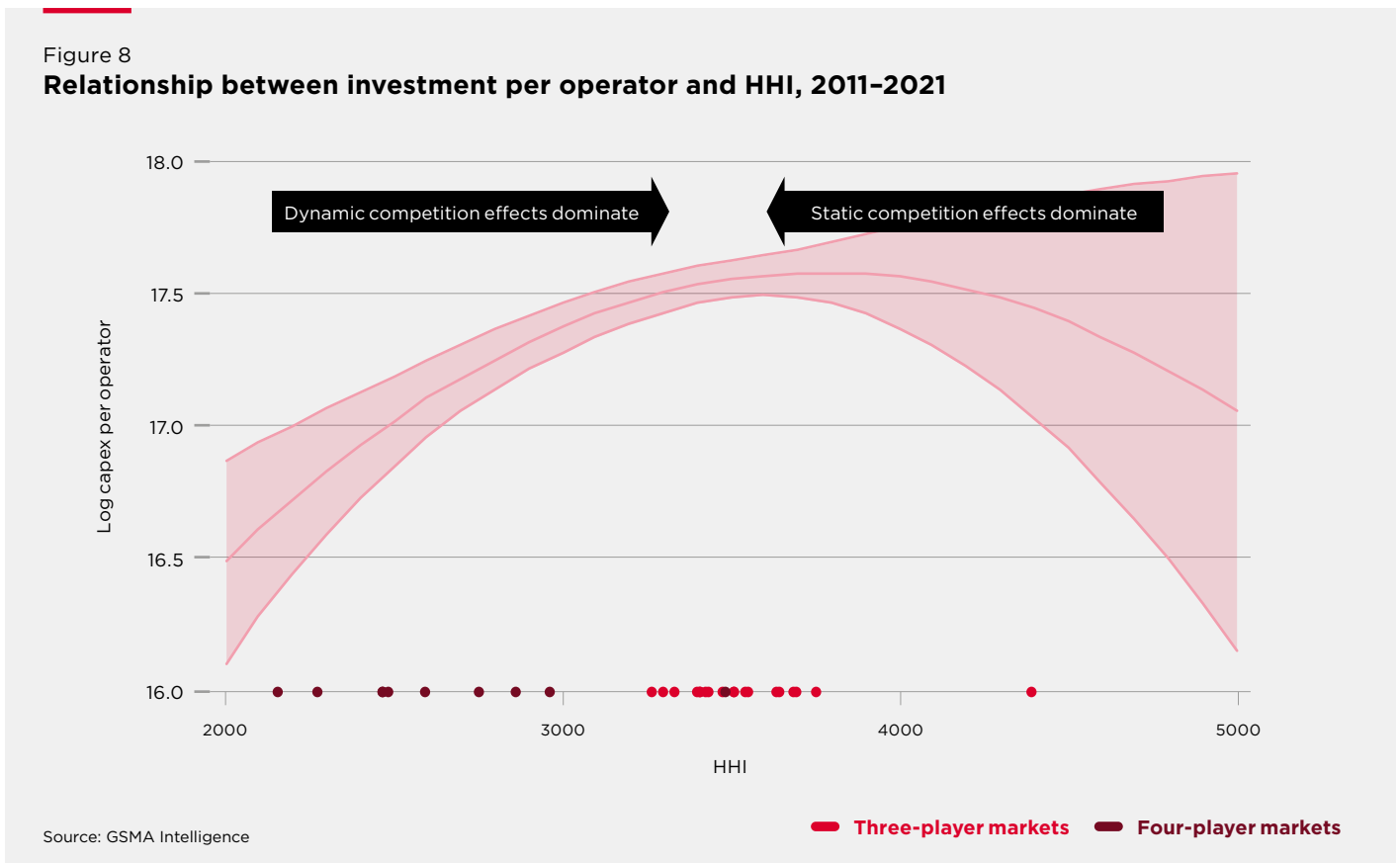
To establish robust correlations and causal effects, an empirical strategy in a multivariate analysis setting is required.

A recent economic [research paper](#) from GSMA Intelligence shows how competition dynamics in Europe impacted investment and mobile network performance during 2011–2021. Overall, the results indicate that the trends observed in competition and investment levels are partly explained by dynamic competition effects. The link between low concentration and profit margins and reduced investments per operator is statistically significant and robust to all robustness checks.

There is also clear evidence to suggest that the relationship between competition and investment follows an ‘inverted U’ shaped curve, with investments increasing with market concentration until reaching an optimal point where investment is maximised. From that point, further increases in market concentration or profit margins are associated with reductions in investment levels. These findings are supported by economic theory<sup>17</sup> and have been found in previous empirical studies too.<sup>18</sup>

Figure 8 shows the predicted values of HHI that would maximise investment levels. Increasing HHI drives higher investment to an HHI of between 3500 and 4000. Plotting the values of these metrics against the actual values in different European markets indicates that in all four-player markets concentration and profitability levels are below the levels that would optimise investment. For example, based on the average HHI at the end of 2021 in four-player markets (around 2700), the analysis suggests investment per operator is around 33% less than the optimal level that would be achieved with greater market concentration.

Separately, we also assessed the link between aggregate investments at a country level and market structure. In the presence of large fixed costs, and everything else being equal, mobile markets with more players will experience a degree of duplication of infrastructure, which could suppose greater aggregate investments overall. However, the analysis shows that these relationships do not hold; aggregate investment levels are not impacted by market structure. The results are therefore consistent with findings at the operator level and imply that individual players in less concentrated markets are delivering lower capex efforts per operator.



<sup>17</sup> Competition and Innovation: An Inverted-U Relationship, Aghion et al, 2005

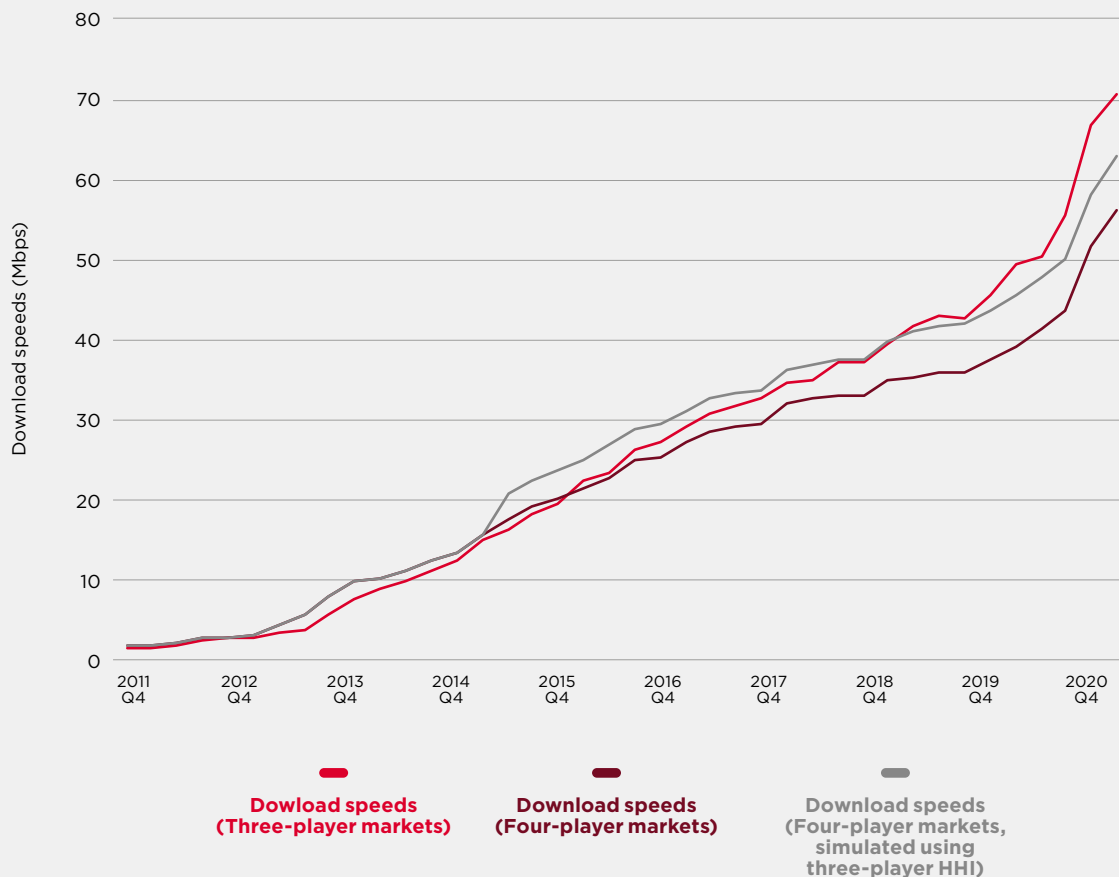
<sup>18</sup> For a comprehensive discussion of previous empirical papers, please see [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=4175243](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4175243)



While investment can be a useful proxy, it is ultimately an input that impacts features important to consumer welfare, such as quality, product differentiation and innovation. Our econometric results indeed show how, from 2015, a decrease in market concentration or profit margins is causally linked with a decrease in network quality. This effect explains at least in part the differences observed in overall network quality trends between three- and four-player markets from 2015. When looking at download speeds, if four-player markets had the average concentration levels that were seen in three-player markets, download speeds would have been 6.6 Mbps (or 12%) higher by 2021 (see Figure 9).

Finally, our econometric analysis confirms what can be observed in trends in Figure 4 – that there is no statistically significant relationship between market structure and ARPU as a proxy for consumer prices. This highlights how in technology-intensive sectors such as mobile communications, dynamic competition forces can be the main driver of consumer price reductions, as new network technologies are able to deliver services at a fraction of the cost of previous generations.

Figure 9  
**Potential effect on download speeds from increasing HHI**



Source: GSMA Intelligence analysis, based on Speedtest Intelligence® data provided by Ookla®

# 04

## Conclusions

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### Appropriate competition dynamics and incentives must be in place to generate investments.

In this study, we assessed how competition dynamics in Europe impacted investment and mobile network performance during 2011–2021. Compared to international benchmarks and Europe's three-player markets, four-player markets in Europe were characterised by lower concentration levels and profit margins. From 2015, four-player markets in Europe also experienced lower investment as a proportion of revenues and per connection, and did not improve service quality (download, upload, latencies) to the same degree as three-player markets in Europe.

The results of the econometric analysis indicate that these trends can be partly explained by dynamic competition effects. The link between lower concentration and profit margins and reduced investments per operator in Europe over this period is highly statistically significant and robust to a range of alternative methodologies and checks. Economic theory predicts these results when dynamic competition effects are significantly stronger than static competition effects.

The evidence in this report indicates that market dynamics in many countries in Europe, especially in four-player markets, did not generate the optimal conditions that maximise investment levels. Improving dynamic competition conditions such as scale and incentives to obtain a return on investment would likely result in greater investment and better services for consumers. European policymakers should

therefore carefully consider the full range of policy levers that can generate the market outcomes desired in terms of investment, quality and prices.

The analysis also shows how in technology-intensive sectors such as European mobile markets, relatively more concentrated markets can generate large incentives to invest, differentiate and improve products, and innovate, to the benefit of consumers. A balanced consideration of the positive effects of mergers on dynamic competition incentives and investments is therefore needed. For example, regulatory remedies that artificially create entry do not necessarily strengthen the dynamic competition conditions that the evidence shows are needed to enhance welfare.

In summary, if the right market conditions are not present, it will be challenging to meet the ambitious digital targets set by European policy leaders for the rollout of 5G networks in Europe. 5G networks require large investments. As the evidence in this report shows, the appropriate competition dynamics and incentives must be in place to generate these investments. Competition policy can cause significant efficiency losses, related to costs, network quality and deployment, by not giving the appropriate weight to the long-term effects of investment and innovation on consumer welfare. European policymakers should therefore re-evaluate their approach to competition policy, acknowledging the crucial role of investment in delivering consumer welfare and strengthening Europe's competitiveness in global markets.



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