
Comments on the Mobile Telecoms Sections of the European Commission's Report on the State of Competition in the EU

Critical Assessment of EC-commissioned Price-Concentration Analysis

Padilla, Small, Klein, Reynolds
02 October 2024

Abstract

This paper reviews an empirical study of the impact of market concentration on prices and investment in retail mobile communications markets set out in "Exploring aspects of the state of competition in the EU", a study commissioned by the European Commission. The study finds that a reduction in the number of MNOs can be expected to lead to an increase in Average Revenue Per User (ARPU) and a reduction in the market-wide volume of capital expenditure (CAPEX). The study also finds that the number of MVNOs in a market has no impact on ARPUs.

Overall, we find that the study does not provide any useful insights into the impact of market concentration on consumer outcomes. In particular:

- **ARPUs are not a good proxy for the prices of mobile services, because ARPUs are a function not only of unit prices, but also of usage levels and quality of service.** Therefore, even if the study was correct that a reduction in the number of MNOs is associated with an increase in ARPUs, this would not necessarily indicate an anti-competitive outcome, as it could be driven by an increase in usage and/or a quality improvement, rather than an increase in unit prices.
- **Market-wide CAPEX is not a good proxy of network quality, such as download speeds and coverage, which is what consumers ultimately care about.** If markets with four MNOs are found to have higher market-wide CAPEX than markets with three MNOs this might be due to a larger amount of duplication of fixed costs, rather than investment in quality upgrades.
- **The study's findings may not apply to the impending 5G era.** The study focuses only on the 4G era, but deploying a 5G network is much more costly compared to earlier generations of mobile technology.

Finally, the empirical approach used in the study suffers from several methodological issues, which casts doubts on the reliability of the results. These include the use of the number of MVNOs as a measure of the competitive constraints imposed by MVNOs in a given market. This measure is unreliable, as it does not take into account the market shares the MVNOs have been able to obtain.

1 Introduction

- 1.1 The effect of mergers between mobile network operators ('MNOs') on consumers is an important question for competition authorities and an active area of economic research. The European Commission recently cleared a joint venture between Orange and MasMovil in Spain (subject to conditions) and the Competition and Markets Authority is currently assessing a proposed joint venture between H3G and Vodafone in the UK.¹
- 1.2 The European Commission has recently published a study led by economics consultancy Lear, "Exploring aspects of the state of competition in the EU", which includes an assessment of the impact of concentration in the mobile telecommunications sector on prices and investment ('the EC Study').²
- 1.3 The EC Study relies on data on market structure and market outcomes in 29 countries (of which 23 are EU member states) for the period from 2009 to 2019 (which it dubs the "4G era"). It studies the effect of a change in the number of MNOs in a country (through horizontal merger or new entry), number of Mobile Virtual Network Operators ('MVNOs'), and of the country's Herfindahl-Hirschman Index ('HHI') on the level of prices (proxied by ARPU) and investment (proxied by total CAPEX) in that country.
- 1.4 Its main conclusions are that:
- a. higher concentration is associated with higher prices - for example, in the EU, an additional MNO reduces ARPU by 9%;
 - b. higher concentration is associated with lower investment - for example, in the EU, an additional MNO increases market-wide CAPEX by 9%; and
 - c. an increase in the number of MVNOs in a country does not affect ARPU but slightly increases total CAPEX.
- 1.5 The EC Study adds to a significant body of literature, which investigates how changes in mobile market concentration impact market outcomes. In a recent article published in the European Competition Law Review, Compass Lexecon's economists set out a review of that literature (our 'Meta Study'),³ particularly focused on the effect of four-to-three MNO mergers since 2010. Our Meta Study showed that such mergers:
- a. had little impact on prices, typically having no effect at all, or increasing prices for some customers for a short period of time only;
 - b. improved mobile service quality in many cases, for example, by extending network coverage and increasing download speeds; and

¹ Three of the authors (Jorge Padilla, Thilo Klein, and Paul Reynolds) are advising the parties on the proposed UK transaction. Jorge Padilla and Thilo Klein advised the parties on the transaction in Spain, and have also advised on the 2013 Hutchison/Orange merger in Austria; the 2014 Hutchison/Telefonica merger in Ireland; and the 2015 Wind/Tre merger in Italy. Thilo Klein advised on the 2016 Hutchison/O2 merger in the UK and the 2018 T-Mobile/Tele2 merger in the Netherlands. The views expressed in this paper are the sole responsibility of the authors and cannot be attributed to Compass Lexecon or any other parties.

² European Commission (2024), "Exploring Aspects of the State of Competition in the EU". The impact of changes in mobile market concentration on prices is assessed in Section 2.2 and the impact on investment in Section 2.3.

³ Padilla, J. et al. (2024) "Do four-to-three mobile mergers harm consumers? A review of post-merger effects and concentration studies", European Competition Law Review, (5), pages 180-219.

-
- c. led to either no change in the rate of decline in MNOs' average revenue per gigabyte (used as a proxy for quality-adjusted prices) or even accelerated such a decline.
- 1.6 In our Meta Study, we noted evidence that market-specific and merger-specific factors matter and would need to be taken into account in assessing the likely effects of any proposed merger. Our previous research shows that there may be a greater likelihood of pro-competitive effects as a result of a merger involving market laggards (i.e. smaller scale challengers) rather than a market leader.⁴
- 1.7 In the remainder of this paper, we comment on the EC Study.
- a. In Section 2 we show that, while at first it might appear that the EC Study and our Meta Study come to very different conclusions on the effects of four-to-three MNO mergers on market outcomes, this is not the case. They are consistent. Even if it were the case that a reduction in the number of MNOs causes an increase in ARPU and/or a reduction in total CAPEX, these findings are ambiguous when we consider how they affect consumers. An increase in ARPU and/or a reduction in total market-wide CAPEX is not necessarily indicative of competition concerns; it could also be consistent with a pro-competitive effect to the benefit of customers. Our Meta Study provides additional evidence that helps us assess the EC Study's findings, to determine which interpretation is more likely.
 - b. In Section 3 we explain that even if the apparent headline findings of the EC Study (i.e. that market concentration in the mobile telecoms sector leads to higher prices, less investment, or both), were valid, they would not be applicable to the 5G era. The EC Study focuses only on the 4G era and relies on data up to 2019. Deploying a 5G network is much more costly compared to earlier generations of mobile technology. 5G increases MNOs' need for scale and can be expected to increase the potential pro-competitive effect of four-to-three mergers. Any relationship between concentration and investment (or prices) which the EC Study identifies may apply to the 4G era but is likely to have changed with the development of 5G.
 - c. In Section 4 we discuss several methodological issues with the EC Study, which cast doubts on the reliability of its finding that an increase in concentration leads to higher ARPU and lower market-wide CAPEX. Such issues include the assumption that mergers and entry have the exact opposite effect; that regressions using HHI may fail to identify the effects of mergers; the lack of a meaningful measure of MVNO competition (which means the analysis may fail to identify the effect of such competition); and shortcomings in the CAPEX data relied on.

2 The empirical results of the EC Study do not support its conclusions

- 2.1 Even if taken at face value, the empirical results of the EC Study do not support a presumption that MNO mergers are anti-competitive. We show this for the analyses of ARPU and market-wide investment in turn.

Effects on ARPU

- 2.2 As the EC Study recognises,⁵ ARPU has limitations as a proxy for price. ARPU is a measure of consumers' average expenditure on mobile services. Variations in ARPU do not necessarily imply price differences (e.g. in the price per gigabyte of data), but may reflect changes in consumption

⁴ Padilla, J., S. Piccolo and P. Reynolds, "Merging laggards", Journal of Competition Law and Economics, Vol. 20, Issue 1-2, March 2024, p. 20-49.

⁵ EC Study, p.84.

- levels and in the services taken by consumers (e.g. services with faster download speeds vs lower speeds), or a combination of these factors.
- 2.3 On its own, it is ambiguous what this finding implies about competitive outcomes for consumers. A reduction in the number of MNOs causing ARPU to increase does not necessarily imply an anti-competitive effect of a price-increase. It may also imply a pro-competitive effect, if the ARPU increase was due to an increase in average volumes consumed or a different composition of services taken.
- 2.4 This issue is particularly relevant to the case of MNO mergers, because such mergers can be expected to increase the parties' combined network capacity.⁶ Greater network capacity supports greater data volumes on the network, allowing MNOs to offer more of their customers larger data bundles at the same price, which would show as an increase in ARPU. Additionally, MNO mergers typically also improve quality along other dimensions, including faster download speeds and better network coverage.
- 2.5 Accordingly, the EC Study's finding that a reduction in the number of MNOs (or an increase in the HHI) causes ARPU to increase does not support a presumption that MNO mergers raise prices and are therefore likely anti-competitive. It might be that the increase in ARPU by MNO mergers leads to an increase in consumption volumes and/or improves the quality of the service.
- 2.6 The evidence provided by our Meta Study on the effect of four-to-three MNO mergers since 2010 suggests a pro-competitive interpretation of the EC Study's findings on ARPU, which otherwise have ambiguous implications for consumer welfare. Our study found that the mergers typically had no effect on price, resulted in increased quality, and reduced cost per gigabyte. This suggests that the changes in ARPU found in the EC Study should not be interpreted as detrimental to consumer welfare.
- 2.7 Our conclusion, that an increase in ARPU may be a pro-competitive effect, is not affected by the EC Study finding that an increase in concentration may be associated with high prices for a low-usage basket of services, for the following reasons:⁷
- a. The low-usage basket measures the price of a very limited service and is therefore of limited relevance. This basket contains only voice and SMS with no data usage.⁸ It is likely that the vast majority of customers would not use such a basket. For this reason alone, limited weight should be placed on these findings.
 - b. Basket prices may increase if there is an improvement in the quality of service (e.g. coverage). Hence the EC Study's finding might just reflect merger-induced quality improvements.
 - c. The estimated effects on basket prices are far smaller than the estimated effects on ARPU and are not statistically significant.

⁶ The capacity an operator supplies is a product of its sites and its spectrum. Consolidating two networks into one is not additive; it is multiplicative, providing more capacity than the sum of its former parts.

⁷ The results using the pricing basket data are set out in Table B.5. As noted at p.84 of the EC Study, there are some shortcomings with using a fixed basket; for example, a basket may not fully reflect actual prices paid by consumers.

⁸ The source of the basket prices used in the EC Study is publicly available ITU data. From 2008 to 2017, the basket is composed of 30 calls and 100 SMSs; from 2018, it is composed of 70 voice minutes and 20 SMSs. See <https://datahub.itu.int/data/?i=34622&e=GBR>.

- d. Our Meta Study considered revenue per gigabyte, a proper indicator of price per unit of service consumed. We found that the four-to-three mergers since 2010 generally led to no change in the rate of decline or an accelerated decline in average revenue per gigabyte.

Effects on market-wide CAPEX

- 2.8 The EC Study finds a positive correlation between the number of MNOs and total CAPEX per country across mobile operators.
- 2.9 Again, even if taken at face value, this finding would not support a conclusion that MNO mergers tend to diminish investment and must therefore be presumed to be anti-competitive for the following reasons:
- a. A large proportion of the costs of building a mobile network are fixed in nature, such as the roll-out of a nation-wide grid of radio sites, regardless of the number of customers that will ultimately be served. Entry of an additional network may lead to a substantial increase in total CAPEX in the affected country.
 - b. A finding that with more MNOs there is more investment in a country does not support an inference that an additional MNO will increase the quality of service. The entry of an additional MNO may plausibly lead to a situation where the same quality of service is provided to consumers with more duplicated costs for mobile operators.
 - c. By the same token, a merger-induced reduction in investment at the country level does not imply that the quality of service is reduced.
- 2.10 As a matter of fact, the exact opposite may be true. The integration of two networks (by rolling out party A's spectrum on party B's radio sites and vice versa) may substantially enhance both the capacity and the quality offered by the network. As a consequence, an MNO merger may lead to a substantial improvement of service, while at the same time eliminating duplicate fixed costs and reducing total CAPEX across mobile operators in the affected country.
- 2.11 For this reason, it is beneficial to assess the relationship between the number of MNOs and quality measures directly.⁹ European markets in which there was a four-to-three merger increased their quality ranking (as measured by the GSMA's network performance index) between 2014 and 2022.¹⁰ Additionally, there is evidence of parties involved in such a merger increasing their quality following the merger (e.g. in terms of download speeds and network coverage) relative to rivals in most of these examples and for Sprint/T-Mobile in the US.¹¹

3 The conclusions may not be applicable to the 5G era

- 3.1 While the EC Study is focused on the 4G era, there are reasons to believe that investment in deploying an advanced 5G network nationally requires greater scale than was the case with 4G.

⁹ The EC Study show an analysis based on capex per connection, and on this basis finds similar results as with market wide capex. However, this does not provide any additional insight. Mobile telecoms markets have long been saturated. Therefore, the number of subscribers in a country tends to be quite stable over time, and the effect of new entry or an MNO merger on capex per connection will be very similar to the effect on market-wide capex.

¹⁰ Our Meta Study, Figure 1.

¹¹ Our Meta Study, p.181-194.

-
- 3.2 While 4G was largely able to be deployed using incremental network investments, advanced 5G requires a large scale rollout of new radio equipment and antenna elements (Massive Multiple In Multiple Out or “Massive MIMO”) using mid-band spectrum and high-capacity fibre backhaul across thousands of sites.
 - 3.3 It is clear that investment is required to strengthen or rebuild infrastructure at significant cost to support the advanced antennas needed and the further spectrum to support the ongoing rapid growth in mobile data demand. Advanced 5G also requires significant additional investments in edge and core networks (e.g. a new 5G core network and dense network of data centres close to users).
 - 3.4 The greater capacity of a 5G site allows for significantly more data to be delivered to consumers as compared with a 4G site, and has the potential to offer a lower cost per unit, but only if a mobile operator has sufficient scale to efficiently utilise the 5G capacity.

4 Methodological issues of the EC Study

- 4.1 We have identified several methodological issues that raise doubts about the reliability of the empirical findings in the EC Study.

The assumption that entry effects are the exact opposite of merger effects may understate the pro-competitive effects of mergers

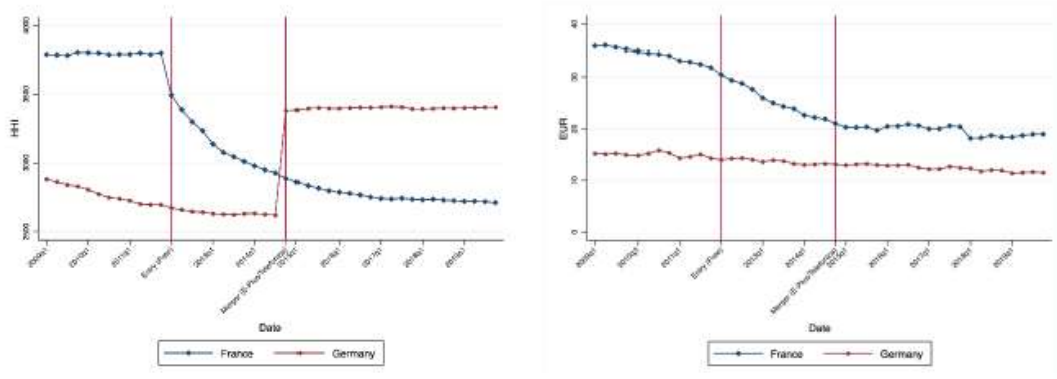
- 4.2 The analysis in the EC Study assumes that an increase in the number of MNOs through new entry has (in value terms) the opposite effect on ARPU and total CAPEX as a reduction in the number of MNOs through a merger. However, this assumption is unlikely to reflect the real relationship between these outcomes and market concentration. MNO mergers can give rise to significant efficiency gains from combining complementary assets; a new MNO entering the market does not have any such effect.¹² Additionally, mergers have a more immediate effect, whereas new entry does not have an immediate impact because entrants take time to grow.
- 4.3 For these reasons, the main results of the EC Study – that an increase in concentration increases ARPU and decreases total CAPEX – are not a reliable guide to the effects of mergers between MNOs. Even if the analysis did not suffer from other methodological issues we have identified, the analysis would be likely to understate the pro-competitive effects of such mergers.
- 4.4 Consistent with the above, the EC Study presents empirical evidence which suggests that the main findings are driven mainly by new entry, rather than by mergers:
 - a. The EC Study presents separate regressions that analyse only the effect of entry by new MNOs (i.e. mergers are excluded from the sample).¹³ The ARPU-reducing effect of adding a new MNO estimated in these analyses is around twice as strong as in the analysis that also considers mergers. The same is true for the estimated effect on total CAPEX per country.

¹² We have previously found that mergers between industry laggards have a significant potential to be rivalry-enhancing, leading to lower quality-adjusted prices and higher consumer surplus (Padilla, J., S. Piccolo and P. Reynolds, “Merging laggards”, *Journal of Competition Law and Economics*, Vol. 20, Issue 1-2, March 2024, p. 20-49). This is more likely to happen when the laggards face a significant investment cost such that the investment will only be profitable when limited to a few players. A merger between laggards can make it more likely that the laggards undertake such investments as the new merged entity.

¹³ EC Study, Table B.6.

- b. Consistent with this, Figure 2.5 of the EC Study suggests that a new MNO entering in France in 2012 substantially reduced ARPU, whereas the merger between Telefonica and E-Plus in 2014 in Germany had no visible effect on ARPU (reproduced as Figure 1 below). (ARPU has in fact consistently been approx. eight EUR/month lower in Germany with three MNOs than in France with four MNOs.)

Figure 1: The impact of entry and merger on market concentration and ARPU



Source: EC Study, Figure 2.5.

Regressions using HHI may fail to identify the effect of mergers

- 4.5 To predict how a change in HHI (e.g. due to a merger) would affect prices in a market, it is necessary to answer the following question: how would prices in the market change if a change to HHI were imposed, and all else were held constant? This would be the causal effect of HHI on prices. It is not sufficient to establish that HHI is correlated with prices: such correlation can arise from a range of factors that are unrelated to any causal relationship between HHI and prices.¹⁴ Comparing prices before and after a merger is a better way of measuring the causal effect of mergers between MNOs than the HHI approach taken in the EC Study.
- 4.6 While the EC Study’s introductory chapter notes weaknesses of price-concentration studies and references a leading paper by Miller et al. (2022),¹⁵ it does not appear to have adequately taken into account the fundamental problem with regressions of price on HHI. Price and HHI are both equilibrium outcomes that are determined by demand, supply and the factors that drive them. As such, a regression of price on HHI that does not adequately capture this will not provide reliable evidence on the size of a causal effect of HHI on price, which is the effect that would be relevant to predict the competitive effects of a merger. As Miller et al. state: *“Empirical analyses based on such regressions of price on the HHI are uninformative about the likelihood of any adverse competitive effects from a merger. Courts and other policy-makers therefore should not rely on regressions of price on the HHI for the purposes of antitrust merger review”* (p.250).

¹⁴ E.g., in markets where the cost of operating is high, prices may be high (because the cost is high) and concentration may be high (because high costs make entry less attractive).

¹⁵ Miller, Berry, Scott Morton, Baker, Bresnahan, Gaynor, Gilbert, Hay, Jin, Kobayashi, Lafontaine, Levinsohn, Marx, Mayo, Nevo, Pakes, Rose, Rubinfeld, Salop, Schwartz, Seim, Shapiro, Shelanski, Sibley, Sweeting and Wosinka (2022), “On the misuse of regressions of price on the HHI in merger review”, *Journal of Antitrust Enforcement*, Volume 10 (2), pages 248–259.

- 4.7 The EC Study attempts to address these issues by using an instrumental variable approach. However, this approach does not resolve the weaknesses that it tries to resolve.¹⁶ The objective of the EC Study is to study a causal relationship between changes in market concentration and prices. In this context, use of the HHI as a measure for market concentration can only yield valid results if the changes in HHI are entirely due to exogenous changes in market structure.
- 4.8 However, in such circumstances, the HHI adds no valuable information: one might just as well directly look at the effect of the exogenous events on prices. We did this in our Meta Study, where we studied the changes in price (measured by revenues per gigabyte) before and after a merger and found that four-to-three mergers had little impact on prices.¹⁷

Further issues regarding the empirical strategy

- 4.9 The regression models in the EC Study include several control variables, including GDP per capita, the share of economically active persons in the population, and the share of the population above 65 years old. However, they do not include other time-varying, country-specific factors such as spectrum allocations and coverage obligations. These omissions are likely to be significant given that 4G spectrum was assigned at different times across countries and that spectrum allocations are likely to affect prices (by impacting the incremental costs of adding capacity) and spectrum allocations and coverage obligations are likely to impact investment.
- 4.10 The EC Study's panel data model also assumes that the relationship between total industry CAPEX per capita and its determinants is similar across all the countries in the dataset. However, this underlying assumption is not tested in the EC Study and was rejected in our Meta Study, where we tested it as part of our review of Ofcom's 2020 study of the relationship between mobile concentration, investment and quality.¹⁸ This is not surprising given the major differences in how CAPEX per capita evolved across countries.
- 4.11 The EC Study found that the number of MVNOs do not have a statistically significant effect on prices but have a positive effect on total CAPEX per country. However, the number of MVNOs is unlikely to provide a reliable basis on which to test the competitive significance of MVNOs. Some countries have many MVNOs with a small combined market share.¹⁹

¹⁶ The instrument used in the EC Study, standard deviations of mobile termination rates ('MTRs'), is also not suitable. An appropriate instrument would need to cause higher or lower HHIs while not affecting prices (except through its effect on HHIs). However, the EC Study describes the relationship between HHIs and MTRs as one where large asymmetries between MNOs (i.e., high HHIs) cause asymmetries in MTRs (as regulators would impose asymmetric MTRs to reduce asymmetries in market shares).¹⁶ But this means that changes in the endogenous variable (HHI) causes changes in the instrumental variable (MTRs), which is the opposite chain of causality required by a valid instrumental variable strategy.

¹⁷ The EC Study also uses within-country differences in mobile termination rates (MTRs) as an instrument, but provides no analysis of how well these charges perform as instruments. Moreover, if the analysis seeks to explain how price depends on concentration through instruments, those instruments must be uncorrelated with price. It is not a priori clear that this is the case. There may be a relationship between within-country difference in MTRs and prices: if MTRs are passed on to retail prices, within-country differences in MTRs may impact retail prices.

¹⁸ Ofcom Economic Discussion Paper (2020), "Market structure, investment and quality in the mobile industry".

¹⁹ For example, in 2021, there were four MVNOs in Ireland with a combined subscriber share of 12.6% (WIK, "[The role of MVNOs in evolving mobile markets](#)", October 2021, Table 5-2 and Figure 5-5), whereas the Japanese Ministry of Internal Affairs and Communication registered 1515 MVNOs with a combined contracts' share of 13.4% ([FY2023 telecommunications report](#), pages 6 and 7).

The data relied upon

- 4.12 The EC Study uses GSMA estimates of total CAPEX per country, on the grounds that actual CAPEX data for many operators is missing. However, it is questionable whether the GSMA estimates are an appropriate basis for an analysis of merger effects on investment, for the following reasons:
- a. The EC Study relies on estimated CAPEX and is therefore less likely to capture any relationship between market concentration and CAPEX. In our Meta Study²⁰, we found that the GSMA does not have data for all operators in a country, and has estimated the CAPEX of such mobile operators.
 - i. The estimate is based on the number of base stations needed to meet industry volumes, holding service quality constant. Because GSMA estimates CAPEX on the assumption that quality is held constant, the estimated value will fail to reflect any quality improvement following a merger. An analysis based to a significant extent on these estimates will be biased towards finding that mergers do not produce quality improvements - even if they in reality do.
 - ii. This use of estimated CAPEX is significant. When looking at a longer period of time (2000 to 2018) used by the Ofcom study²¹, over 93% of the by-country and by-quarter total CAPEX figures are based to some extent on GSMA estimates rather than actual MNO CAPEX. This leads to over 65% of the total industry CAPEX being estimated (i.e. actual CAPEX reported by individual operators accounts for less than 35% of the overall industry estimate) in at least half of the quarters in the period.²²
 - b. The EC Study relies on a measure of CAPEX that conflates investment that is relevant to consumer benefits with other factors. The GSMA estimates of total CAPEX by country are estimates of nominal, not real (i.e., the volume of) CAPEX, and so over time these estimates of total CAPEX will reflect changes in the prices of investment goods and services, as well as changes in real investment. It is changes in real investment (e.g. new sites and new equipment numbers) that is most relevant to considering potential consumer benefits from higher CAPEX. It is unlikely that nominal CAPEX provides a reliable proxy for how real CAPEX has evolved. This makes it less likely that any results identified by the EC Study reflect the true relationship between market concentration and consumer benefit.

²⁰ Our Meta Study, p.205.

²¹ Ofcom Economic Discussion Paper (2020), "Market structure, investment and quality in the mobile industry".

²² When we cross-checked the GSMA estimates with actual data available for Ireland, we found that the GSMA estimate of industry CAPEX substantially overstated actual CAPEX, with the extent of overstatement varying materially across the timeframe (Our Meta Study, p.205).