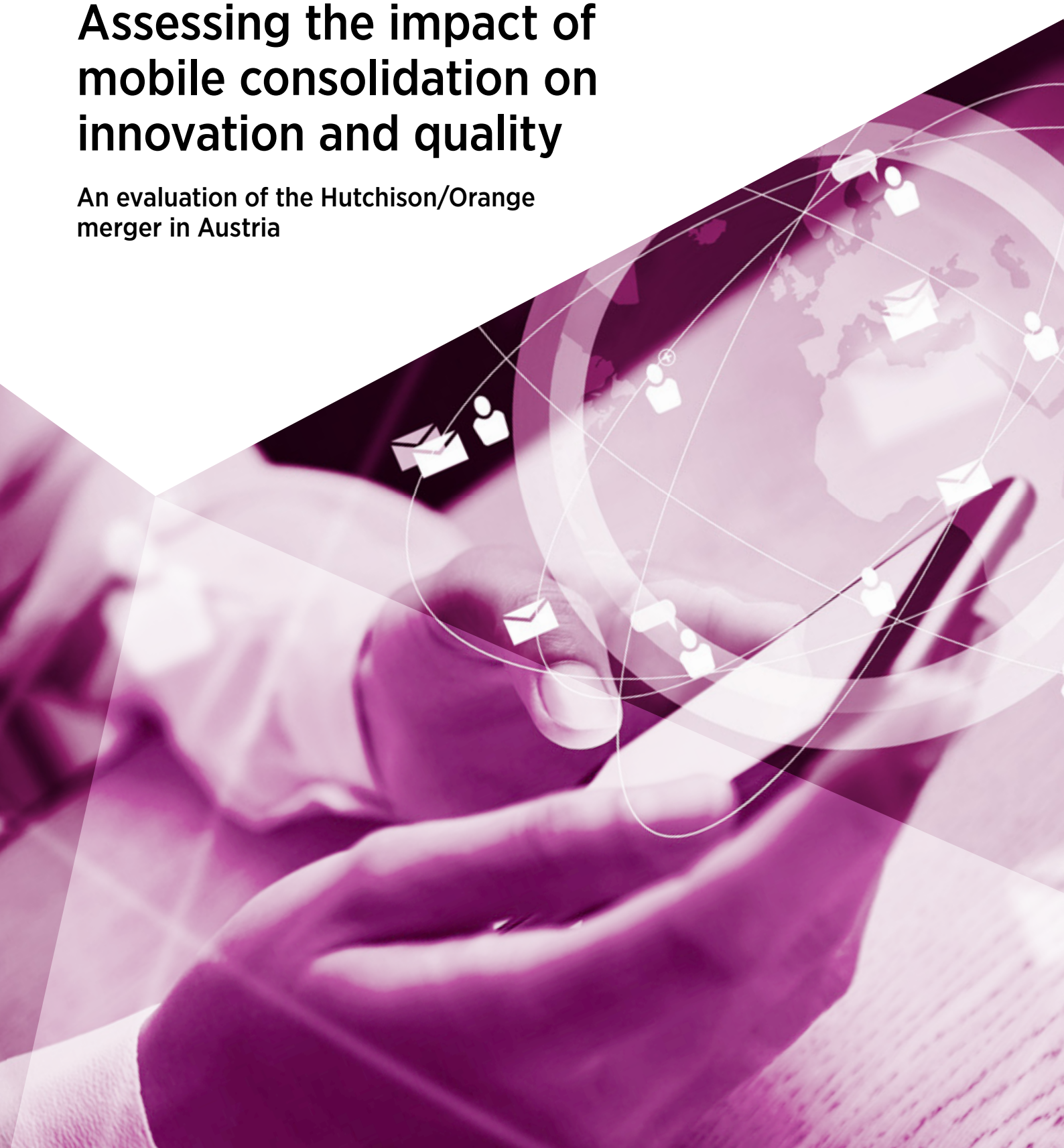
Assessing the impact of mobile consolidation on innovation and quality

An evaluation of the Hutchison/Orange merger in Austria



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Executive summary

This study analyses the impact of the 2012 merger between two mobile operators in Austria – Hutchison 3G Austria and Orange – on 4G network coverage, download speeds and upload speeds. It is the first of its kind to measure the impact of a mobile merger on network quality and innovation outcomes as experienced by the consumer.

The merger between Hutchison and Orange in Austria involved the combination of the two smallest operators in a four-player market, which included rivals A1 Telekom and T-Mobile. In its assessment, the European Commission (EC) argued that Hutchison and Orange were close competitors and Hutchison was regarded as an important competitive constraint. For this reason, the EC concluded that the merger would reduce competition and increase prices, to the detriment of consumers.

At the time of the assessment, Hutchison claimed that the merger would deliver a number of efficiencies, including improved 4G coverage and improved quality of service. These did not pass the burden of proof, in particular merger-specificity and benefits to consumers. Eventually the merger was approved after Hutchison agreed to implement a set of remedies.

We find that the merger had a significant positive impact for Austrian consumers. Hutchison was able to accelerate population coverage of its 4G network by 20–30 percentage points as a result of the merger, with this taking effect after two years. Hutchison's 4G network quality also increased significantly, with 4G download and upload speeds increasing by 7 Mbps and 3Mbps respectively two years after the merger.

We also find positive effects on the quality of mobile networks in the Austrian market as a whole, with 4G download and upload speeds increasing by more than 13 Mbps and 4 Mbps in 2013 and 2014 respectively after the merger, and 3G download speeds increasing by 1.5 Mbps after 2014.

While this study and its findings are specific to Austria, the results show that a 4-to-3 mobile merger intensified competition in quality-related aspects and that a three-player market delivered more widely available and faster 4G services than those experienced in four-player markets. It also shows that a merger between the two smallest operators in Austria allowed them to significantly outperform other operators in Europe with a similar position in the market.

The report, therefore, makes an important contribution to building the evidence on which competition authorities and regulators can base their decisions when considering dynamic efficiencies and the relationship between market structure and market performance in mobile markets. In particular, the findings from this study have two key policy implications:

- First, merger efficiencies and the impact they have on consumers can be measured with the right framework and data. Competition authorities can leverage this study and newly available data to develop analytical approaches that systemically assess the likely impact of a merger on network quality and innovation (as is currently done for price), test merger-specific effects, as well as model quality and innovation impacts in antitrust cases.

- Second, efficiency effects can be significant but can take time to directly benefit consumers. For competition authorities to take into account all relevant effects, merger control tools need to consider effects beyond the short-term.

1. Introduction

This report assesses the impact of a merger in the mobile sector on direct measures of consumer welfare other than prices – in particular, the network quality and network coverage levels experienced by consumers. Using data from GSMA Intelligence and Ookla, this original work evaluates the impact of the merger between Hutchison and Orange in 2012 in Austria. We use two well-established policy evaluation methods, recently used by RTR (2016) and DG Competition (2015), while innovatively applying them to direct measures of network quality and coverage.

Our results indicate that the Hutchison/Orange merger led to improvements in network quality and coverage in the Austrian market. Two years after the merger, Hutchison's 4G population coverage was 20–30 percentage points higher than it would have been if the merger had not taken place. The merger also significantly increased Hutchison's 4G download and upload speeds by approximately 7 Mbps and 3 Mbps respectively. Moreover, merger effects spilled over to rivals A1 Telekom and T-Mobile, with statistically significant improvements in 3G and 4G network quality.

These are significant findings as the impact of consolidation on mobile markets continues to be a matter of debate in Europe and beyond. While a number of countries in Europe have experienced a reduction in the number of network operators from four to three players (Austria in 2012, Ireland and Germany in 2014), in other countries merger proposals have been blocked by competition authorities (e.g. the UK in 2016) or in the case of Italy approved on the condition that the market retains four players.[1]

As a matter of law and practice, competition authorities should generally try to assess the impact of mergers on overall consumer welfare, encompassing factors such as price, quality and innovation. However, some recent assessments of proposed mobile mergers have primarily relied on (often short-term) price effects as the main source of evidence for the impact on consumers – for instance, with the use of calculations such as upwards pricing pressure tests. Meanwhile, efficiency considerations on how the merger can affect quality and innovation outcomes have received less weight and have often not been considered in the initial review, as authorities require a high burden of proof.

Recent survey evidence shows that while prices are important to consumers, other features of mobile services such as network coverage and quality of service are equally important. For instance, in 2016 77% of Austrian mobile consumers said that network coverage was either 'the most important' or 'a very important' factor when switching operator, compared to 75% for cost and 63% for reliable data connection speeds.[2] At the same time, governments have set ambitious goals with regards to mobile internet performance and coverage. This will require continued levels of investment and network innovation, for example to roll out 5G technology.

A mobile merger can affect quality and innovation in different ways. On the one hand, competition authorities are concerned that the increased concentration may drive a potential loss of competition that could reduce the incentives to invest. On the other hand, existing market structures in some markets may hinder operators' incentive and ability to invest and achieve greater efficiencies. Going forward, this may make it difficult for operators to meet expectations around technology upgrades, universal coverage, and quality of services. In this context, merging parties often argue that consolidation gives them stronger investment incentives – due to greater financial strength and substantial scale efficiencies – that may result in a better experience for consumers of mobile services.

Recent research has attempted to understand how a change in market structure affects quality and innovation from the investment angle. At this stage, the available evidence indicates that more market concentration has either a positive or neutral effect on investment – so far, no study has found a negative effect. However, no research has assessed the impact of market concentration or consolidation on the direct outcomes for consumers. This report focuses on this important aspect.

1. See cases M.6497 for Austria in 2012, M.6992 for Ireland in 2014, M.7018 for Germany in 2014, M.7612 for UK in 2016, M.7758 for Italy in 2016.
2. Source: GSMA Intelligence Consumer Survey.

2. Mobile mergers, quality and innovation

2.1 Quality, innovation and consumer welfare

Competition authorities are required to assess mergers by looking at the likely effects of the merger on consumers. These include a range of characteristics that are important to consumers, such as price, quality and innovation.

While the guidelines that authorities follow when assessing mergers acknowledge the importance of all these outcomes[3], significant emphasis is put on (often short-term) prices. Many mobile mergers have heavily focused on tests of short-term price effects (e.g. upward pricing pressure calculations), which can easily trigger competition concerns in investment-intensive industries. Meanwhile, dynamic benefits and their possible effects on the quality of mobile services have often faced a strong burden of proof.[4]

This focus on short-term price effects can be a particular concern for mobile markets, where consumers may attach more importance to quality and variety than price, particularly where mobile operators offer differentiated products and services. Figure 1 summarises survey evidence for the EU28 and a selection of countries on the importance to consumers of cost, quality and service related criteria when accessing the internet. It shows that quality-related criteria are almost as important as cost-related criteria, and in some countries (for example Austria and Germany) even more so.

3. See EC's Horizontal Merger Guidelines.
4. Nitsche & Wiethaus (2016).

Figure 1

Key factors for consumers when accessing the internet

Source: E-Communications and the Digital Single Market (May 2016)
Consumers were asked "When subscribing to an internet connection, what are the main factors you consider? Firstly? And then? (Maximum 4 answers)".
Numbers represent the percentage of respondents that mentioned criteria related to cost, quality and service.

The above is also supported by survey evidence collected by GSMA Intelligence in 2016 – in Austria, 77% of mobile consumers said that network coverage was either 'the most important' or 'a very important' factor when switching operator, compared to 75% for cost and 63% for reliable data connection speeds.[5] Consumer research carried out by Ofcom in the UK also regularly finds that consumer satisfaction with a mobile service is dependent on mobile coverage, quality of service, reliability and customer service.[6] Going forward, these non-price factors are likely to be increasingly valued by consumers. A consultation by DG Economy and Society showed that mobile connectivity features such as download and upload speeds, latencies and reliability will significantly increase in importance by 2025.[7]

When markets are characterised by frequent cycles of technology change, the relationship between innovation and consumer welfare needs to be carefully considered. The nature of competition and technology change in mobile markets means that new mobile services are introduced regularly, as shown in Table 1: SMS and MMS in the 1G-to-2G transition; advanced internet browsing in the 2G-to-3G transition; and video streaming and conferencing in the 3G-to-4G case. Such transitions improve the quality of existing services (e.g. speeds increase and latencies fall in each cycle). Innovation also introduces cost savings in the provision of existing mobile services, allowing consumers to benefit from lower unit prices.

5. Source: GSMA Intelligence Consumer Survey.
6. Source: Ofcom Consumer Experience reports.
7. Source: DG Economy and Society (2016), "Synopsis report of public consultation on the needs for Internet speed and quality beyond 2020".

Table 1

Characteristics of mobile technology cycles

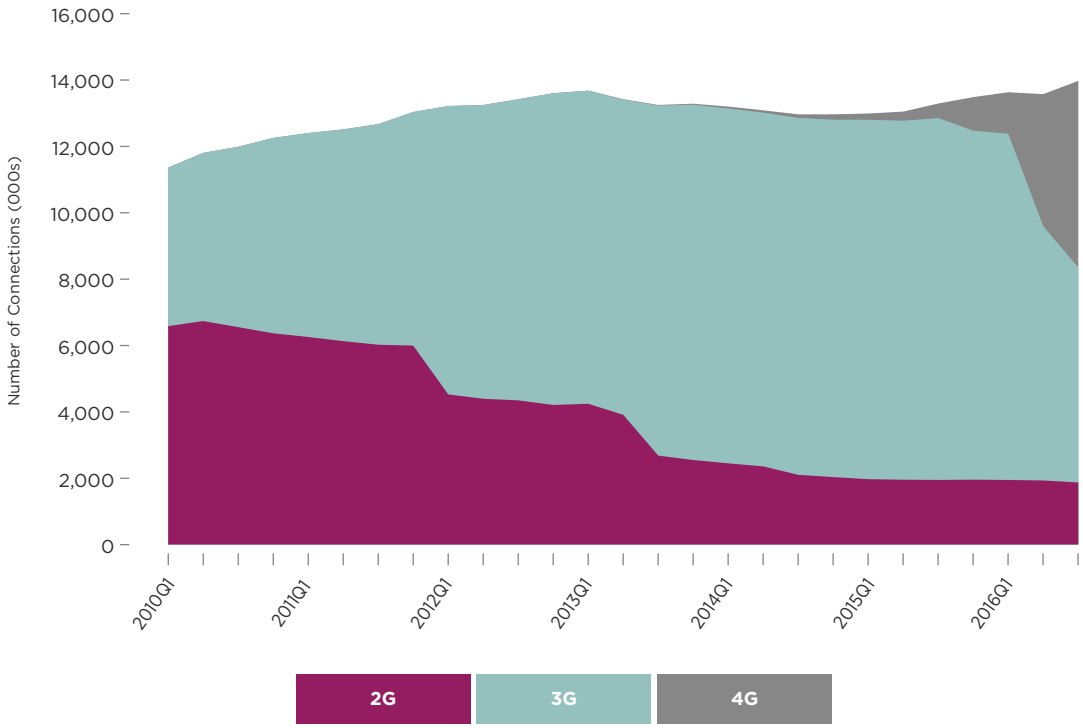
	1G	2G	3G	4G
Cycle length	1980–1990	1990–2006	2006–2011	2009–Present
Supports	Voice	Voice and data	Voice and data	Voice and data
Applications	Voice calls	Voice calls, SMS, MMS, browsing (limited)	High-speed browsing, applications	Video conferencing, mobile TV
Band type	Narrow band	Narrow band	Wide band	Ultra-wide band
Speed	2.4–14.4 kbps	14.4 kbps	3.1 Mbps	100 Mbps

Source: GSMA Intelligence

Figure 2 shows the transition across network technologies from the demand side, looking at the number of connections by technology.

Figure 2

Number of connections by technology in Austria



Source: RTR

2.2 The Hutchison/Orange merger

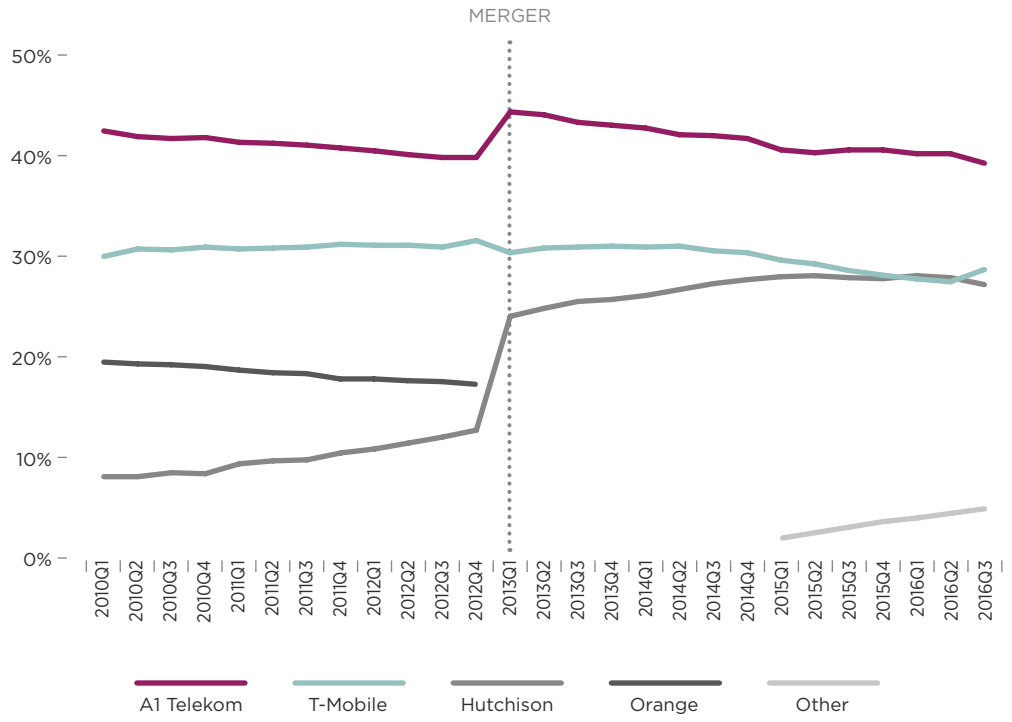
The merger between Hutchison and Orange in Austria involved the combination of the two smallest operators in a four-player market, which included rivals A1 Telekom and T-Mobile. In its assessment, the European Commission (EC) argued that Hutchison and Orange were close competitors and Hutchison was regarded as an important competitive constraint. For this reason, the EC concluded that the merger would reduce competition and increase prices, to the detriment of consumers.

While Hutchison claimed that the merger would deliver a number of efficiencies, these did not pass the burden of proof, and eventually the merger was approved on the basis of three remedies. First, spectrum would be divested and additional rights would be provided to a potential new mobile network operator (MNO). Second, Hutchison would host up to 16 MVNOs, which would have access to up to 30% of its capacity on pay-as-you-go terms. Third, Hutchison committed not to complete the acquisition of Orange before it entered into a wholesale access agreement with one mobile virtual network operator (MVNO).

The first commitment did not become effective as no new operator entered the market following the merger. The MVNO commitment became effective following an agreement with UPC, which entered the market in December 2014. Hutchison subsequently signed three more MVNO agreements in 2015 and 2016.

Figure 3

Evolution of retail market shares in Austria[8]



Source: RTR

The merged operator initially remained the smallest operator but it has recently reached a similar market share to T-Mobile. At the same time as the merger, A1 Telekom acquired Orange's Yesss brand, increasing its market share. A1 Telekom remains the biggest operator but market shares are more symmetric than before the merger.

8. The 'Other' category includes MVNOs.

2.3 The potential effect of the Austrian merger on quality and innovation

The potential effect of the merger on Hutchison

Anticipating the effect of consolidation on merged operators' quality and innovation is complex. In the case of the Hutchison/Orange merger, a number of effects were, in theory, possible.

The merger could have weakened the incentives to innovate and invest. This could happen because after the merger the remaining operators face one less competitor in the market, so there could be less of a need to improve the performance of their networks and to innovate to win and retain customers.[9]

At the same time, however, there were a number of mechanisms by which the Hutchison/Orange merger could have improved network quality and network innovation in the Austrian market. Specifically, the merger could have strengthened the ability and incentives to invest and the efficiency of investment. These all represent mechanisms by which a merger could drive dynamic efficiencies – i.e. the introduction of innovations which drive increased choice and performance and lower prices for mobile services.

First, the Hutchison/Orange merger could have affected quality and innovation outcomes by increasing profitability in the market, which should improve the ability to invest across all operators. Post-merger, the merged operator could have been financially well equipped to cover the costs (often sunk) and deal with the uncertainties around rolling out coverage, network upgrades or innovation more generally.[10] Post-merger, Hutchison would have also enjoyed scale economies[11], increasing its capability to improve coverage and network quality. Additionally, bigger operators can enjoy stronger investment ability via other benefits associated with operator size – for instance, greater bargaining power in infrastructure purchases or ease of finding partnerships in related industries (e.g. mobile money, smart cars).[12]

Second, the merger could have increased the expected returns on investment, which would in turn improve the incentives to invest. After the merger, operators in the market would have been better equipped to recover the investments in their network. [13]

The merger could have also affected network quality and innovation through efficiencies. Operators often stress that the aggregation of complementary assets (particularly spectrum and sites) generates two types of efficiencies.

- Since bigger entities are able to combine spectrum and sites more efficiently,[14] a merger can result in higher network quality that directly benefits consumers – i.e., a demand-side efficiency.[15]

- Supply-side efficiencies may arise because the combination of networks may allow a merged operator to supply mobile services at lower costs. For instance, having more spectrum allows operators to build capacity with fewer sites, therefore incurring lower network costs.[16] Additional supply-side efficiencies may arise due to denser distribution networks and lower selling, general and administrative expenses per subscriber. These cost savings are likely to provide higher margins, in turn driving stronger ability and incentive to invest.

In the Hutchison/Orange merger, the parties argued that the merger would provide the incentives to continue the growth strategy of the merged entity and that it would increase the number of sites by approximately 50%. Hutchison argued that its customers would benefit from better mobile services via four efficiencies.

1. By combining Hutchison's and Orange's networks, the merger would increase capacity, which would allow for faster and higher quality services and would alleviate congestion in the network.

2. The combination of network assets would also allow Hutchison to roll out LTE nationwide within a short time period.

9. While the EC acknowledged the possible existence of these efficiencies, they did not pass the tests of verifiability, merger-specificity and consumer benefits. The EC argued that there was not enough evidence supporting these claims and that, even if these existed, they would need to be verifiably translated into network quality and/or lower prices in order to constitute proof of consumer benefit.
10. The grounds of this view were formalised in the economics literature by Schumpeter (1942).
11. For example, it would have a larger customer base over which to spread fixed and common costs.
12. WIK (2015).
13. Nitsche & Wiethaus (2016) noted that short-term margins provide solid investment incentives, particularly in investment-intensive industries such as telecoms.
14. As pointed out in WIK (2015): "LTE requires a minimum amount of contiguous spectrum and connection speeds can be further increased with larger blocks of spectrum. Larger operators may also be able to realise a more efficient mix of spectrum in low frequency bands (for coverage) and spectrum in high frequency bands (for capacity)".
15. See Evans & Padilla (2003).
16. See https://www.ofcom.org.uk/__data/assets/pdf_file/0021/58314/2nd_condoc_annex_6.pdf

3. The coverage of the combined network would be superior to the current coverage of Hutchison's and Orange's networks.

4. The merger would reduce Hutchison's scale disadvantages, which would facilitate upcoming investments and generate cost savings that would be used to develop new services and to price more competitively.

While the EC acknowledged the possible existence of these efficiencies, they did not pass the test of verifiability (with the exception of scale advantages). The EC also said that the benefits brought by the combination of networks were not merger-specific as they could be achieved by other means, such as network sharing, though the merging parties argued this was not feasible due to incompatible network and business strategies. Lastly, the EC also argued that the efficiencies could not be verifiably translated into benefits to consumers, either in the form of improved network quality and/or lower prices.[17]

The potential effect of the merger on Hutchison's competitors

The Hutchison/Orange merger could have also affected the network quality of its rivals A1 Telekom and T-Mobile. On the one hand, the competitors of the merged operator may also experience lower competition intensity, so their incentives to innovate and invest may be reduced. On the other hand, competitors may expect higher expected returns on their investment and, therefore, have a stronger ability to invest, which in turn is likely to result in greater coverage and higher quality for their networks.

Separately, competitors may also strategically react to the merged operators' outcomes of coverage and network quality – or to expectations around these – just as they react to pricing. If the merged operator improves its network performance and coverage (for instance, due to network efficiencies), then rival operators would have the incentive to respond accordingly to maintain their competitive position.[18] Therefore, the merger could also lead to increased competition intensity.

The dynamics of these strategic responses can be complex because changes in network quality and coverage can take time to plan and execute – unlike prices, which can be changed quickly and regularly. This particularly applies to the merged entity, which has to undergo a process of network and business consolidation following the merger.[19] The competitors of the merged entity may be able to achieve network quality and coverage improvements more quickly, either in direct response to the merged entity increasing quality or in the expectation that it will do so.

The evidence around market structure, quality and innovation

A number of studies have examined the relationship between market structure, innovation and investment – as measured by operators' capital expenditure (capex). At this stage, no study has found increasing market concentration to drive lower investment per operator or lower total country investment.

A first set of studies has found that investment always increases with market concentration, suggesting that the Hutchison/Orange merger would have had a positive effect on Austrian consumers via more investment. CERRE (2015) found that, on average, a 10% increase in HHI drives a boost of 24% in merged operators' capex. It has also been found that, on average, markets with four players have 14% lower investment per operator when compared to markets with three players and that, more generally, an increase in the number of operators tends to decrease investment (Jeanjean & Houngbonon, 2016-b). DG Competition (2017) finds that investment per operator increased as a result of the 5-to-4 merger in the United Kingdom in 2010, although no statistically significant effect is found when analysing investment per subscriber.

A second set of studies (Houngbonon & Jeanjean, 2016-a; HSBC, 2015) suggests that greater market concentration increases capex per operator only when operators' profit margins are below 37–44% – with operators in most four-player markets being below this threshold, including Austrian operators before the merger. These studies suggest that the introduction of competition initially has a positive effect on investment and that, as mobile markets become less concentrated, it has a negative effect. In other words, there is an inverted-U relationship between market concentration and investment.

Other studies have found that investments do not depend on market structure (WIK, 2015; Frontier, 2015), suggesting that a mobile merger would have a neutral effect on outcomes such as network quality and coverage.[20]

17. See Section 7 of Case No COMP/M.6497 – Hutchison 3G Austria/Orange Austria.
18. Investments that change quality and innovation are strategic complements in oligopolistic markets with differentiated products such as mobile markets, as shown in Athey & Schmutzler (2001).
19. In this context, assessing the consequences of a merger over a short-term horizon may not lead to the best outcome in the interest of consumers.
20. Though WIK (2015) found that market structures that provide higher profit margins and larger firm scale (both enhanced by market consolidation) positively drive total country's capex.

Table 2

Recent research examining market structure versus investment

Research paper	Measure of investment	Effect of an increase in HHI on investment per operator	Effect of an increase in HHI on total country investment	Scope
WIK (2015)	Capex, capex/subs	No significant effect	No significant effect	50 MNOs, 12 markets, (2005–2013)
Frontier (2015)	Capex/subs	No significant effect	Not addressed	60+ MNOs, EU markets (2005–2013)
CERRE (2015)	Capex	Investment increases	No significant effect	33 markets (2006–2014)
DG Competition (2017)	Capex, capex/subs	Total investment increases, but investment per subscriber is not affected	Not addressed	24 MNOs, 13 markets, (2007-2014)
Houngbonon & Jeanjean (2016-b)	Capex	Investment increases	Not addressed	100 MNOs (2005–2013)
Houngbonon & Jeanjean (2016-a)	Capex	Inverted-U: investment maximised at 37–40% of margin	Not addressed	110 MNOs (2005–2012)
HSBC (2015)	Capex	Inverted-U: investment maximised at 38–44% of margin	Not addressed	66 markets (2003–2013)

Source: GSMA Intelligence

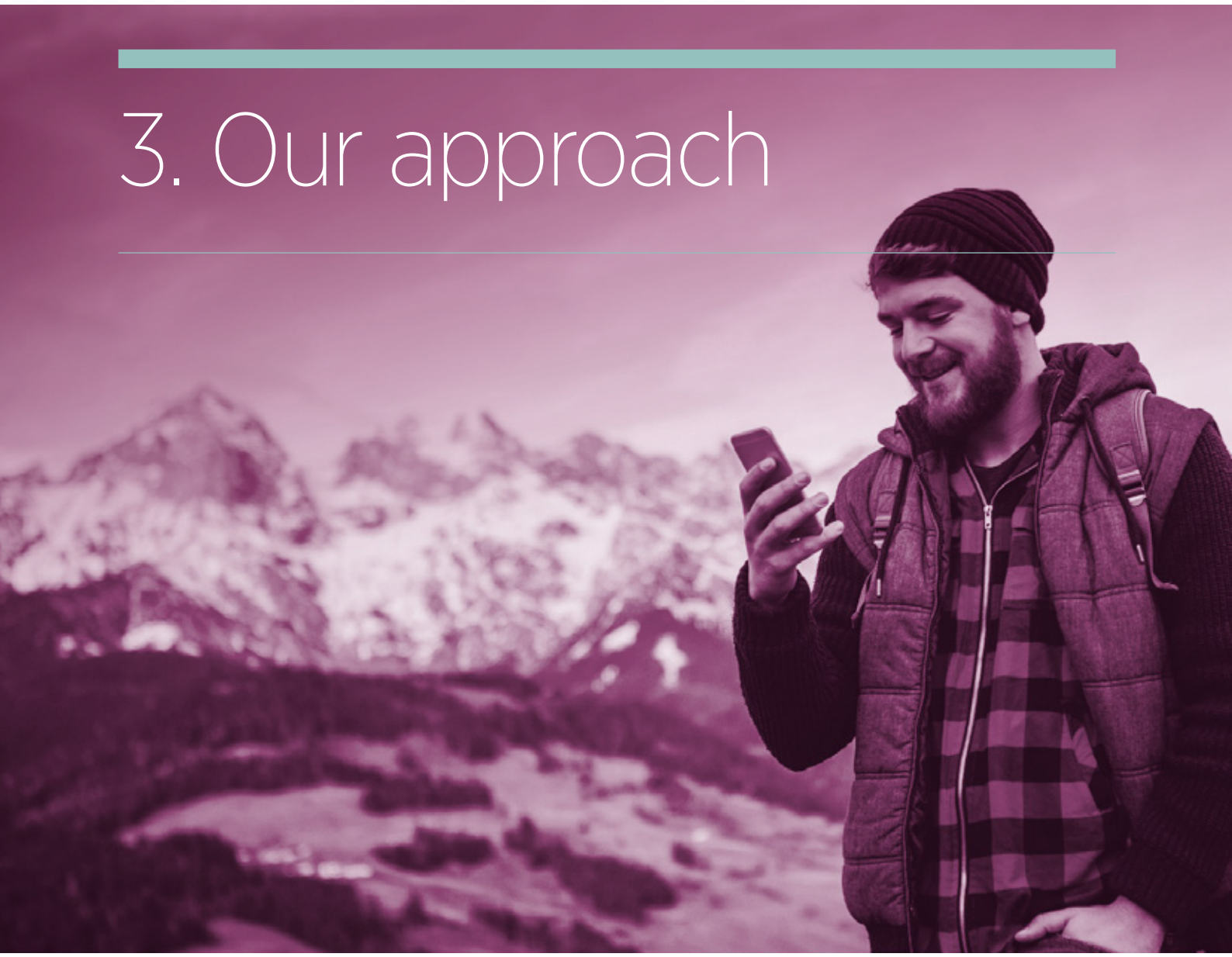
This recent wave of research represents a positive step and a first attempt to look at the effect of changes in market structure on innovation and quality. However, while the results are informative, operator investment may not be a perfect measure for network quality and innovation because it does not represent the final outcome that consumers benefit from. More specifically:

- Investment as a measure of network quality and coverage does not comprehensively capture all the mechanisms by which a merger may affect network quality and coverage. In particular, it does not take into account the efficiencies that mergers may drive, potentially leading to increased quality and innovation with similar (or lower) investment.
- Even if investment was a good measure of quality and innovation in a given market, the use of capex has a number of flaws when it comes to making comparisons across countries. The cyclical patterns of capex make it difficult to compare time series across countries and these measurements are often based on differing methodologies.[21]

This report sets out to address specifically these issues.

21. For instance, capex measures often do not distinguish between investment in fixed and mobile networks, which introduces differences between convergent operators and mobile-only operators.

3. Our approach



In order to assess how the 4-to-3 merger of Hutchison and Orange in the Austrian market affected innovation and quality in mobile services, we firstly develop indicators that measure both network quality and coverage, and secondly apply quantitative techniques so that we can establish with confidence what the impact of the merger was, if any.

3.1 Measuring innovation and quality

Network innovation

Measuring innovation is challenging because it is a broad concept encompassing processes that drive cost reductions and the introduction of new products and services. In this work, we consider the impact on innovation, by looking at 4G coverage, which was the most recent technology being rolled out during the period 2011–2016 (of the Hutchison-Orange merger).

Our coverage data is sourced from GSMA Intelligence[22], which has complete data on 4G coverage by population

22. https://gsmaintelligence.com/

at the country and operator level.[23] The data is sourced directly from operators and regulators whenever they report 4G coverage metrics (e.g. in financial statements, investor presentations and regulatory filings). As the metric is generally reported based on coverage by population rather than by area, we use the former.

One limitation with this data is that operators and regulators do not always report 4G coverage in every quarter, meaning that for certain time periods the data has to be estimated.[24] In order to sense-check these estimates, the 4G coverage data was shared with operators in Austria. Where data was found to be inaccurate, it was updated based on feedback from operators.

Network quality

Capturing the quality of mobile services is complex. A number of parameters are regularly used to establish the quality of voice, SMS and data services, including the following:

- download speeds[25] (higher speeds allow consumers to download content more quickly and use data-intensive applications and content, such as video)
- upload speeds[26] (higher speeds enable consumers to share more content and experience better performance of services such as online gaming)
- latency[27] (relevant for services that require short delays such as video calls, VoIP or online gaming)
- signal strength[28] (which affects the overall quality of voice, SMS and data)
- call reliability (i.e. dropped or blocked calls[29]).

In this work we focus on the download and upload speeds of 4G and 3G networks.[30]

We use data provided by Ookla's Speedtest[31], a crowd-sourcing platform that allows mobile users to initiate a 'speed test' to measure network performance at any given time. Each time a user runs a test, they receive a measurement for download speeds and upload speeds. The test also records the consumer's location, the network operator and the technology being used at the time of the test.[32] In 2016, Ookla had 427 million unique users across Speedtest applications. Using these test results, Ookla calculates the average (mean) network performance metric across all users in each quarter at both the country and operator level. This data is then disaggregated by network technology.

Bauer et al (2010) explain the complexities involved in accurately measuring broadband speeds and the importance of identifying the source of the bottlenecks, particularly as slow speeds can be caused by factors outside the network operator's control. In mobile networks, network performance is affected by many factors including the quality of the handset, the structure of the consumer's tariff plan (speeds are sometimes throttled), time of day, location, being indoors/outdoors, and weather.[33] If the number of tests in a given time period is small, then they are likely to be skewed by one or more of these factors. This makes it difficult to compare performance across countries and operators.

To avoid these biases, the network performance averages we use are based on large samples, which should average out test characteristics.

The observations underlying performance averages are also subject to a sampling procedure carried out by Ookla for Speedtest Intelligence.[34] Table A2.3 (Annex 2) shows that the average number of tests for each country is greater than 100,000 in most quarters (the number of 4G tests is more limited in the early period due to low take-up and limited network rollout). Table A2.4 (Annex 2) presents the same statistics at the operator level. This shows that the average number of tests is greater than 10,000 in most quarters and that every operator has data based on at least 100 tests in a given quarter.

As we work with crowd-sourced data, it is arguable to what extent these sampled measures represent unbiased measures of 'average' consumer experience, due to possible self-selection – e.g. users of network performance applications may be more technologically sophisticated, or they may tend to run tests when their signal is poor. However, so long as there are

23. There are two main ways in which 4G coverage can be measured. One is to look at the proportion of the population in a country that is in an area where 4G networks are available (network coverage by population, based on the location of households and residences). Another is to look at the proportion of a country's geography where 4G networks are available (network coverage by geographic area).
24. For further details on the estimation process, see https://www.gsmaintelligence.com/help/11/
25. Download speed is the rate of data transmission to a user's device. It is usually measured in Megabits per second (Mbps) or kilobits per second (kbps).
26. Upload speed is the rate of data transmission from a user's device.
27. Latencies measure the delay that happens in data communication over mobile networks (e.g., the total time it takes a data packet to travel from one node to another).
28. Signal strength is the power level of mobile signals – received at a particular location – from a mobile network operator. It is usually measured in decibels.
29. Blocked calls happen when the user is in an area of coverage but cannot make a call; this can be because of heavy demand on the mobile network. Dropped calls occur when a call is connected but then terminates unexpectedly; this can happen when a user moves into an area with poor or no mobile signal.
30. We also analysed latencies but the assumptions required under our methodological framework did not hold. We were therefore unable to interpret the results or infer any findings from them.
31. http://www.speedtest.net/mobile/
32. Further details can be found in the Ookla's Methodology document. Available at http://www.ookla.com/methodology/pdf
33. OECD (2014)
34. See http://www.ookla.com/methodology/pdf

no systemic biases across countries (i.e. if most users in all countries are similarly advanced in their use of technology) then the data can be used to do a time series comparison across countries (i.e. a comparison of how these metrics evolve over time).

Overall, we consider that the network performance metrics provided from Speedtest Intelligence are reliable for both countries and operators, and appropriate for the sort of methodologies used in this study, which rely on time series comparisons. We note that many mobile operators use Speedtest Intelligence data when advertising their network quality and benchmarking themselves against their competitors, providing reassurance around the quality of the data. Bauer et al (2010) also found that Ookla's Speedtest approach was the best data source for assessing the speed of broadband access services at the time of writing.[35]

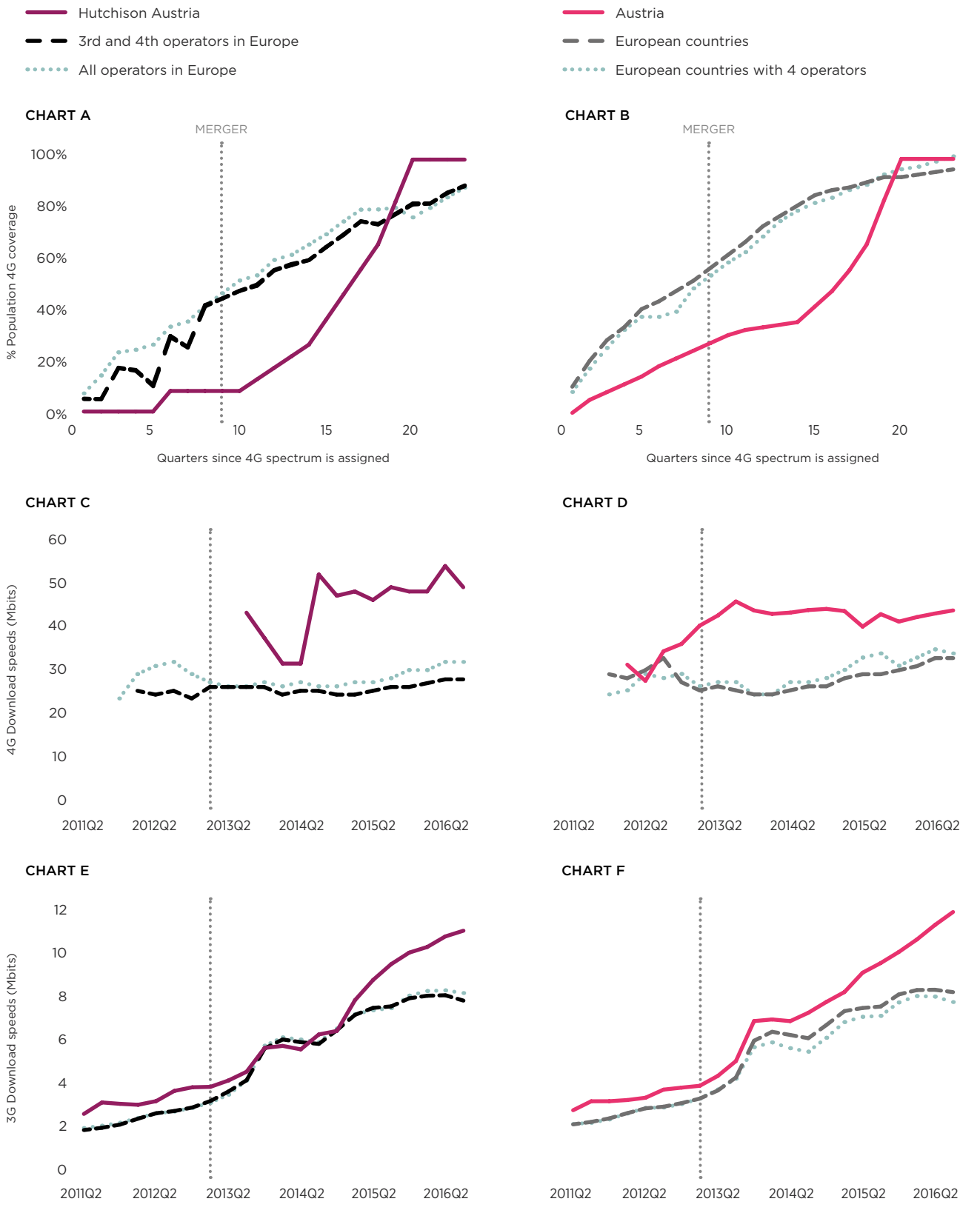
3.2 Pre and post-merger trends in innovation and quality

After the merger, Hutchison's 4G coverage improved rapidly, leading to the merged operator overtaking its rivals A1 Telekom and T-Mobile on 4G coverage. Hutchison achieved full coverage faster than most European operators in markets that experienced no consolidation in the same period. Chart A in Figure 4 shows that Hutchison reached near universal coverage almost 5 years after 4G spectrum was assigned, while the average of other European operators was at approximately 80% at this time. Austria's overall coverage also improved after the merger (Chart B), with the 800 MHz spectrum auction taking place in October 2013. Looking at 4G networks (Chart C), Hutchison's download speeds perform above the average of European operators following the merger. Austria's overall 4G download speeds were performing close to the European averages before the merger, while after the merger this improves substantially – though this trend started before Hutchison and Orange merged (Chart D). Charts E and F suggest a similar trend in 3G network quality – i.e. after the merger, Hutchison and Austria overall appear to improve more rapidly relative to other markets.

35. Further data sources of network quality have been developed since that paper was written but all of them are relatively recent (meaning they have insufficient data for assessing the impact of the merger in Austria).

Figure 4

Pre-and post-merger trends in 4G coverage and network quality[36]



Source: Speedtest Intelligence from Ookla, GSMA Intelligence

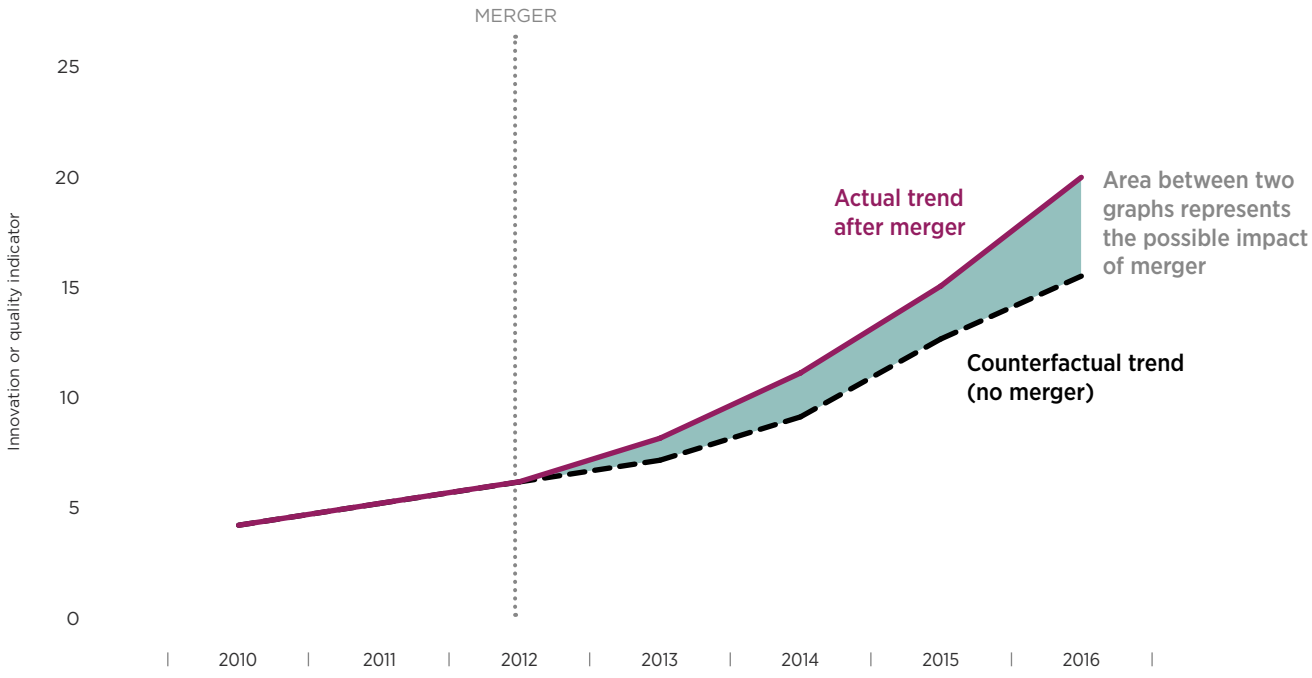
36. The average of European markets includes countries that have experienced no market structure changes (no entry, exit or mergers) in 2011–2016. The countries are: Belgium, Croatia, Czech Republic, Denmark, Greece, Hungary, Italy, Latvia, Malta, Poland, Portugal, Romania, Slovenia, Spain, Sweden, Switzerland and the UK.

3.3 Methodology

In order to determine the effect of the Austrian merger on network quality and coverage, we develop an alternative scenario that captures the likely evolution of these metrics for Hutchison and Austria had the merger not taken place. Once that alternative scenario (also known as the counterfactual) is developed, the impact of the merger can be assessed by comparing the quality and coverage levels that resulted after the merger with the quality and coverage levels in the counterfactual scenario. This is illustrated in Figure 5.

Figure 5

Illustration of counterfactual analysis



Since the counterfactual scenario cannot be observed, we simulate this with two methods that are often used in policy and programme evaluation. These approaches estimate the counterfactual for the network quality and coverage observed in a group of operators or countries that have not experienced a merger – a control group (essentially, a comparator). The approach we take is similar to DG Comp (2015), RTR (2016) and DG Comp (2017), which used the same methods to assess the effects of mobile mergers on prices.

The first method is known as a Difference-in-Differences (DD) approach[37]. In a DD framework, the impact of the merger on quality and 4G coverage is established by comparing the observed changes in Hutchison or in Austria after the merger in 4G coverage or network quality with the changes in the control group. This comparison is carried out with econometric techniques that take into account differences in factors that may be relevant in explaining different network quality and coverage between Hutchison or Austria and the control group (see Figure 6).

37. We follow the approach defined in Angrist & Pischke (2008).

The second method – the synthetic control – is a statistical, data-driven procedure to generate an artificial ("synthetic") comparator for Hutchison or Austria[38]. The synthetic comparator is a weighted combination of other operators or countries, with weights chosen to ensure that the relevant outcome (i.e. 4G coverage or network quality) of the comparator match Hutchison or Austria as closely as possible. The approach requires a set of variables that determine the evolution of the relevant outcome. The variables used are similar to the ones used in the first method to explain differences in network quality and coverage. This procedure is combined with cross-validation techniques to assess the statistical significance of results (see Annex 1 for a more detailed explanation).

Estimating the counterfactual

Constructing a counterfactual involves gathering data from a suitable control group of countries where there was no merger or significant change in market structure during the period of analysis (2011–2016) which therefore can be used to assess the likely trends that would have occurred in Austria in the absence of a merger. Our main control group consists of 17 European countries that did not experience entry or exit in the mobile market in 2011–2016, excluding countries that underwent a change in market structure during the period. The countries in the control group are Belgium, Croatia, Czech Republic, Denmark, Greece, Hungary, Italy, Latvia, Malta, Poland, Portugal, Romania, Slovenia, Spain, Sweden, Switzerland and the UK.

Building a robust counterfactual also involves being able to isolate from the control group those factors that could influence the outcomes of interest (i.e. network coverage and quality) and that are likely to be different across operators and countries, including Austria. Our simulations of the counterfactual scenario predict network quality and coverage as a function of demand and supply factors, including the change in market structure induced by the merger. We account for the fact that operators and countries may be different in a number of supply and demand factors that are relevant for network quality and coverage.

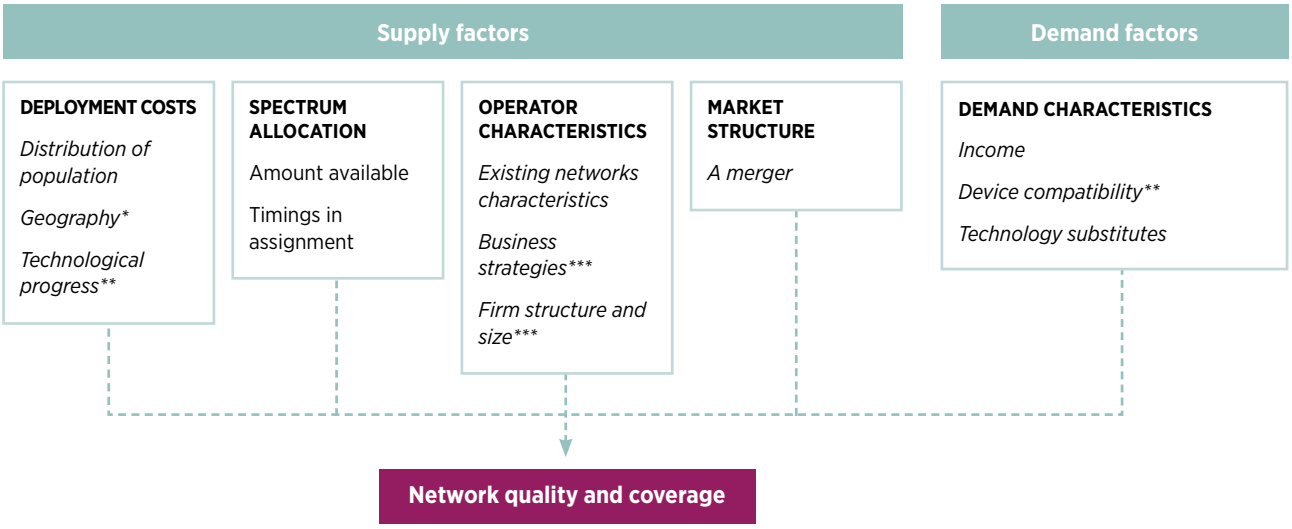
Supply factors include the differences in network quality and coverage arising from the fact that rollout costs vary across countries, depending on aspects such as the distribution of population or geography. Other supply factors include the spectrum governments give access to, the frequencies used and the time that operators have been able to use it. Quality and coverage indicators of new technologies such as 4G are also likely to be driven by the savings arising from the deployment of previous technologies (i.e. 3G), operators' business strategy and firm structure, etc.

Coverage and network quality also depend on demand factors. We take into account that markets vary in terms of consumers' willingness to pay, the access to mobile devices compatible with new networks or the availability of well-functioning technologies (such as advanced 3G) which could influence the demand of consumers for newer networks (i.e. technology substitutes).

38. This is based on Abadie & Gardeazabal (2003).

Figure 6

Inputs used to simulate network quality and coverage in the counterfactual



*Only in DD models, via country fixed effects; **only in DD models, via time fixed effects; ***only in DD models, via operator fixed effects (see the econometric detail in Annex 1).

Source: GSMA Intelligence

In addition to the above we have also considered accounting for other factors, including spectrum by frequency bands, network congestion, network sharing and MVNOs. These factors have not been included in the final results. See Annex A.1.2 for a full discussion.

The timings of merger effects

Due to competitive dynamics between operators and the fact that decisions around network quality and coverage take time to materialise, a general challenge in measuring the effects of the merger is around timings,

Operators can change network quality and coverage levels either via additional investments or due to efficiencies from combining networks. In the latter situation, the efficiencies from sharing networks involve merging infrastructures – a process that can be complex. For example, in the case of Hutchison and Orange, due to preparation, planning, and the selection of a network operator, consolidation of the two networks only started one year after the merger. Network consolidation was finally completed in the first half of 2015.

With regards to additional investments, the timings can vary; some new investments require significant planning and implementation time (for example changes to network architecture or increasing the number of sites), while others can be implemented more quickly (e.g. upgrading software and network equipment at existing cell sites and network nodes).

In order to account for these complexities, our models estimate separate merger effects by year after the merger.

Robustness checks

For the results to be regarded as robust, they must hold to three kinds of checks, which are further detailed in Annex 1.

- We change the control group of operators and countries used to assess the performance of Hutchison and Austria. We do this to verify that the control group is a valid benchmark.
- Estimations are carried out accounting for operator-specific traits such as business strategy or firm structure, which may be relevant in explaining why operators have differences in coverage or network quality.
- Models of coverage are estimated allowing for the inputs introduced in Figure 6 to have a non-linear effect (e.g., consistent with the 'S-curves' typical to coverage).

4. Results

In this section we report the main findings of the analysis with regards to the impact of the Hutchison/Orange merger on the coverage and network quality of the merged operator and the Austrian market as a whole.

Both DD and synthetic control methods are applied to 4G coverage and 3G network quality. In the case of 4G network quality there is no pre-merger data for Hutchison, hence the synthetic control method cannot be applied and the DD approach is implemented using a different framework.[39] In this section we present the estimation results of the base models. The details of the estimation process, as well as the robustness checks on the merger effects, are available in Annexes 1–3.

39. See Annex A.3.2.1

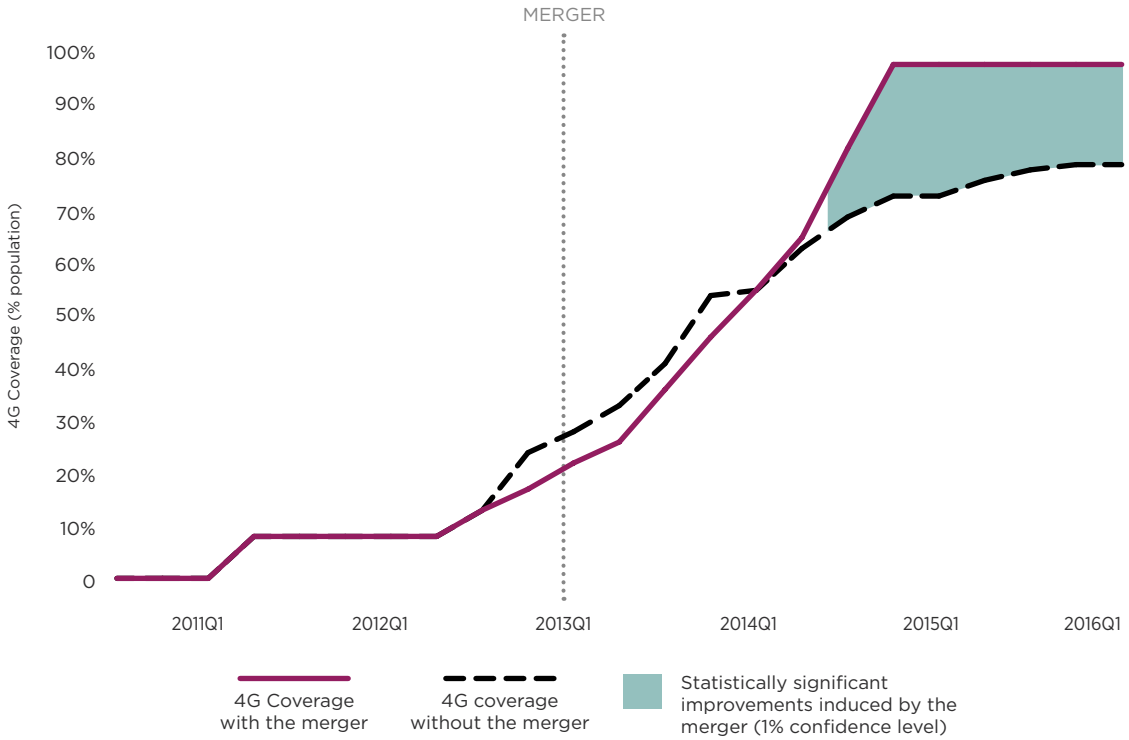
4.1 4G coverage

Merger effect for Hutchison

Our models show that the merger was a key factor in explaining why the rollout of Hutchison's 4G network accelerated after the merger. According to our results, the merger increased Hutchison's 4G coverage by more than 20 percentage points, as compared to the scenario without the merger. As Figure 7 shows, the effect starts to materialise from mid-2014 and fully materialises two years after the merger. These results suggest that the coverage gains that could have been driven by additional investments or by network efficiencies took time to be realised, likely due to complexities around infrastructure management and the processes of business consolidation.

Figure 7

The effect of the merger on Hutchison's 4G coverage



The section of the chart before 2015 represents differences that are not statistically significant at the 1% confidence level.
The trend of 4G coverage without the merger is based on the prediction of the Base DD model as specified in Model 7 of Table 3.

Source: GSMA Intelligence

Table 3 presents the estimates of the base DD model of 4G coverage. No statistically significant effect is observed in either the first or the second year after the merger, but all the simulations carried out give positive and statistically significant effects two years after the merger. These vary between 20 and 30 percentage points depending on the set of controls included.

The results also indicate that spectrum holdings and the timings of spectrum assignments are important drivers of 4G coverage levels. An increase in 4G spectrum holdings of 1 MHz for an operator increases its 4G coverage by 0.1 percentage points (i.e. the allocation of an additional block of 20 MHz increases coverage by 2 percentage points). Similarly, the early

release of spectrum also results in sizeable benefits for consumers. For example, all things being equal, an operator that has been able to use 4G spectrum for 4–6 years will have coverage around 16 percentage points higher than an operator that has had 4G spectrum for less than one year.

Operators' 4G coverage also seems to be significantly influenced by 3G networks, as shown in Model 7 of Table 3. Operators with high 3G coverage also have higher 4G coverage – a 1 percentage point increase in 3G coverage is associated with a 0.44 percentage point increase in 4G coverage. This is expected, as having a large network infrastructure in place allows operators to achieve cost and time savings when deploying newer networks (e.g. no need to apply for planning permission to build a new cell/tower site). However, higher 3G network quality seems to slow down 4G coverage.[40] This could be because if an operator has made significant investments in upgrading their 3G networks, they may wait some time before rolling out a large 4G network, partly to earn a return on their 3G investment and also because their customers may be less willing – or have less need – to upgrade to 4G.

Income (GDP per capita) and share of rural population do not provide consistently statistically significant values. This is likely due to the lack of variation of these variables over time.[41] Population density in a country does however prove to be a statistically significant driver of 4G coverage levels. Overall, the signs of the effects provide reassurance about the results.

Table 3

4G coverage base DD model – merger effect for Hutchison

	(1) 4G cov.	(2) 4G cov.	(3) 4G cov.	(4) 4G cov.	(5) 4G cov.	(6) 4G cov.	(7) 4G cov.
Effect in 1st year	-0.032	-0.0199	-0.0503	-0.053	-0.067	-0.069	-0.082
Effect in 2nd year	0.048	0.0274	0.0357	0.026	0.012	0.016	-0.033
Effect after 2 years	0.277***	0.258***	0.241***	0.220***	0.208***	0.207***	0.214***
4G spectrum holdings		0.001***	0.001***	0.001***	0.001***	0.001***	0.001***
4G spectrum 1–2 years			0.0423	0.0470	0.049	0.060	0.051
4G spectrum 2–4 years			0.0965*	0.101*	0.107*	0.117**	0.102*
4G spectrum 4–6 years			0.157***	0.160***	0.165***	0.176***	0.161**
GDP per capita (log)				-0.480			
Rural population					0.074**		0.0268
Population density (log)						2.259*	2.832***
3G coverage							0.438**
3G download speeds							-0.031***
Observations	948	948	948	948	948	948	923
Adjusted R-squared	0.74	0.75	0.76	0.76	0.76	0.76	0.77

Significance level: *** 1%, ** 5%, * 10%.

Source: GSMA Intelligence

The results presented in Table 3 are consistent with several robustness checks and sensitivity tests, and are further confirmed when assessing the impact using our second method – the synthetic control (see Annex 3).

40. The results in Column 7 of Table 3 suggest that an increase in 3G download speeds of 1 Mbps reduces 4G coverage by 3 percentage points.
41. Models with country fixed effects only take into account how explanatory variables change over time within each country. Income and proportion of rural population do not change much in a country over a period of 6–7 years.

Market-wide merger effects

While the merger resulted in a strong and positive effect on the coverage levels of the merged entity, the results of our analysis with regards to the coverage levels of all the Austrian operators, including A1 Telekom and T-Mobile, are inconclusive. The results of the base DD model indicate a negative merger effect in the first year following the merger, though the tests carried out indicate that these results do not hold to alternative specifications and robustness checks do not give support to the finding of a negative effect. The second approach – the synthetic control – cannot be fully tested due to lack of data. The complete analysis is presented in Section A3 of the Annex.

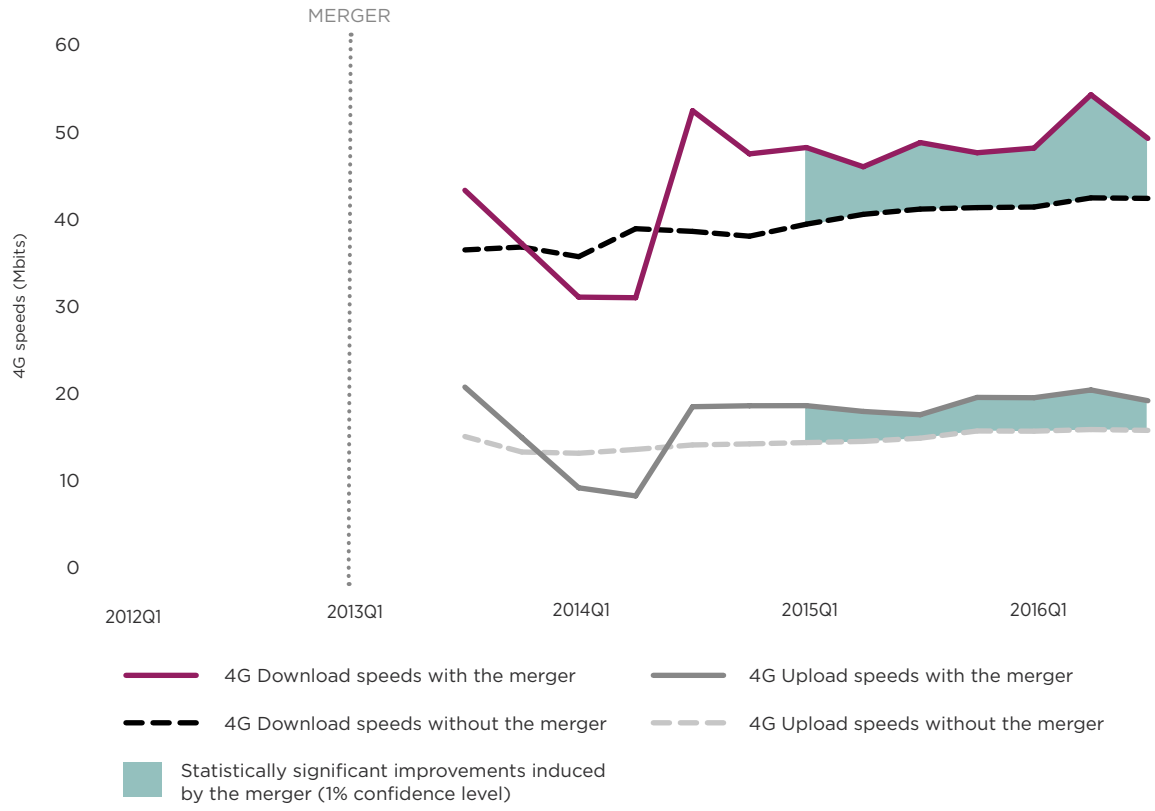
4.2 4G network quality

Merger effect for Hutchison

The results indicate that Hutchison's 4G network performance as measured by download and upload speeds significantly improved after the merger, as shown in Figure 8. These effects were largely concentrated in the second year after the merger and the years thereafter, which is consistent with the timings of the finding on 4G coverage.

Figure 8

The effect of the merger on Hutchison's 4G network quality



The section of the chart before 2015 represents differences that are not statistically significant at the 1% confidence level.
The trends without the merger are based on predictions of the Base model as specified in Model 1 in Table 4.

Source: GSMA Intelligence

We estimate that two years after the merger, download speeds were around 7 Mbps faster than they would have been otherwise, with this effect starting to materialise in the second year after the merger. The models reported in Table 4 also show that we identified some effects in the first year after the merger, though these did not fully pass the robustness checks.[42] 4G upload speeds were affected positively as well, with Hutchison's speeds approximately 3 Mbps faster two years after the merger.[43]

These results are based on the model as reported in Table 4. Due to the lack of pre-merger data on 4G performance for Hutchison Austria it is not possible to fully isolate the impact of the merger. Rather, the results indicate that following the merger (particularly after two years) Hutchison had a better quality 4G network than most other operators in the control group after controlling for other relevant factors.

Table 4

4G network quality base model – merger effects for Hutchison

	4G download speeds			4G upload speeds		
	(1)	(2)	(3)	(4)	(5)	(6)
Effect in 1st year	3.686**	3.381*	3.687**	3.792***	3.667***	3.793***
Effect in 2nd year	2.705***	2.769***	2.727***	-0.0630	-0.0370	-0.0552
Effect after 2 years	7.635***	8.398***	7.673***	3.732***	4.045***	3.745***
4G spectrum holdings	0.034	0.035	0.033	0.004	0.005	0.004
Rural population		-4.632			-1.903	
Population density (log)			-0.177			-0.064
Observations	904	904	904	904	904	904
Adjusted R-squared	0.35	0.36	0.35	0.31	0.32	0.31

Significance level: *** 1%, ** 5%, * 10%.

Source: GSMA Intelligence

Additionally, Table 4 shows that, as expected, spectrum holdings are positively associated with network quality and rural population has a negative effect, though neither of these are statistically significant.

Our findings pass all the standard robustness checks, which generally tend to give higher estimates of the merger effect – particularly when we account for the fact that operators may have different business strategies and firm structures (see Annex 3).

Market-wide merger effects

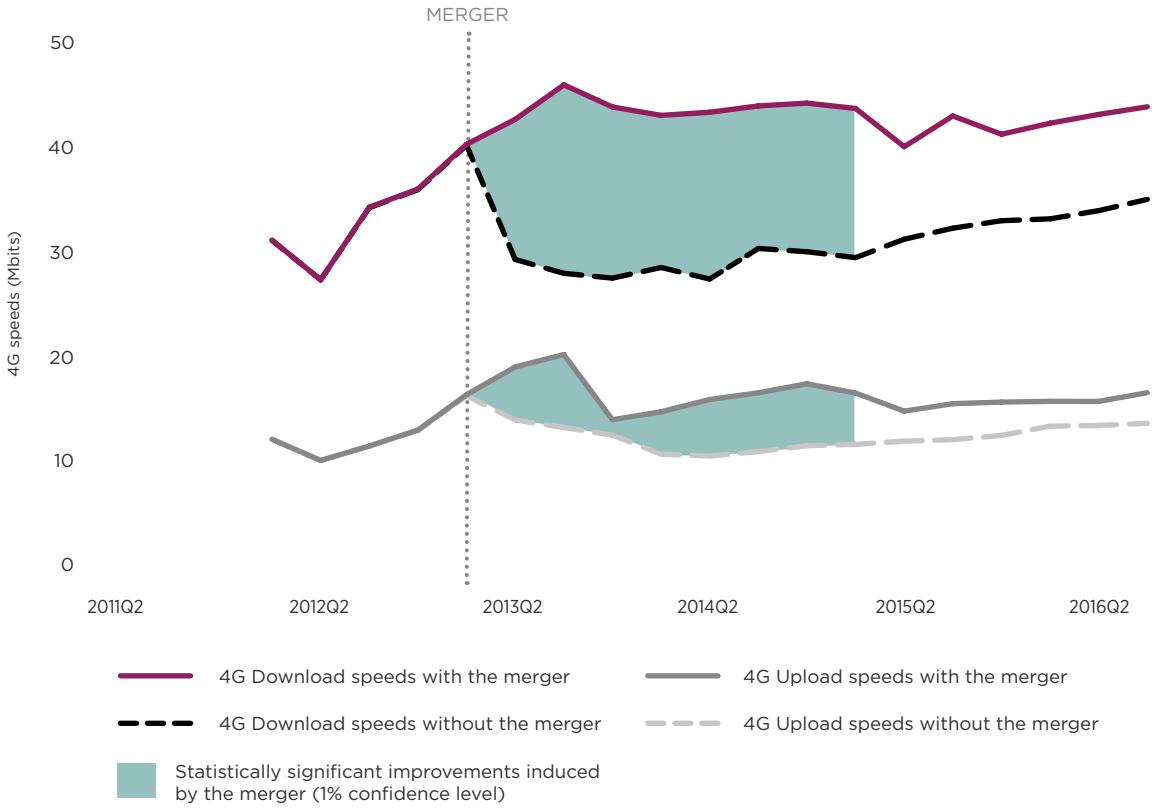
The analysis across all Austrian operators suggests that the market consolidation induced an improvement in A1 Telekom and T-Mobile's 4G network quality. This took place particularly during the first and second years after the merger[44], with the size of the impact identified being stronger as compared to what is estimated for the merged entity.

These results suggest that A1 Telekom and T-Mobile invested more in their 4G networks before Hutchison improved its 4G network, with a number of possible drivers being at play – for example the expectation that Hutchison would improve its networks (as our data shows it indeed did), putting pressure on competitors to also increase their network quality to compete effectively. Other factors potentially at play include competitors expecting greater returns on investment, or expecting to be in a stronger financial position after the consolidation of the market.

42. See section A3 in the Annex
43. The table also suggests there was an effect on 4G upload speeds in the first year of the merger. However, since the effect dissipates in the second year after the merger, we treat it with more caution than the effect after two years.
44. Our estimates indicate a statistically significant average effect over the course of the first and second year. This does not necessarily mean there was an improvement in 4G due to the merger immediately after this took place.

Figure 9

The effect of the merger on 4G network quality across all Austrian operators[45]



The section of the chart after 2015 represents differences that are not statistically significant at the 1% confidence level.
The trends without the merger are based on predictions of the Base DD model as specified in Model 1 of Table 5. Both trends with and without the merger reflect actual and simulated averages of network quality across Hutchison, A1 Telekom and T-Mobile.

Source: GSMA Intelligence

For download speeds, the effect identified across all Austrian operators was between 13 and 16 Mbps over the first and second year. The effect of the merger on upload speeds followed the same timing, with a magnitude of approximately 4–6 Mbps. While Table 5 shows statistically significant effects two years after the merger, this is not illustrated in Figure 9 as a robust result because it was not validated in the alternative scenarios we simulated (see Annex 3).

45. This represents the average merger effect across Hutchison, A1 Telekom and T-Mobile.

Table 5

4G network quality base DD model – market-wide merger effects

	4G download speeds			4G upload speeds		
	(1)	(2)	(3)	(4)	(5)	(6)
Effect in 1st year	13.93***	15.88***	14.08***	5.075***	5.853***	5.127***
Effect in 2nd year	13.09***	15.57***	13.28***	4.171***	5.161***	4.240***
Effect after 2 years	8.322**	11.57***	8.536**	2.587**	3.880***	2.662**
4G spectrum holdings	0.0342	0.0354	0.0336	0.00461	0.005	0.004
Rural population		-4.936			-1.969	
Population density (log)			-0.187			-0.066
Observations	827	827	827	827	827	827
Adjusted R-squared	0.46	0.46	0.46	0.42	0.42	0.42

Significance level: *** 1%, ** 5%, * 10%.

Source: GSMA Intelligence

4.3 3G network quality

Merger effect for Hutchison

Looking at Hutchison's 3G network quality, our models conclude that the effect of the merger was neutral – the merger neither increased nor decreased network speeds. The merger effects of the base DD models do not hold to the robustness checks we rely on, and the synthetic control approach we have applied produces an artificial operator against which Hutchison cannot be reasonably compared.

This result suggests that, after the merger, Hutchison focused on differentiating and improving its networks on the latest technology being rolled out – i.e. 4G – and that potential network efficiencies and additional investments did not affect 3G in the period covered by the analysis.

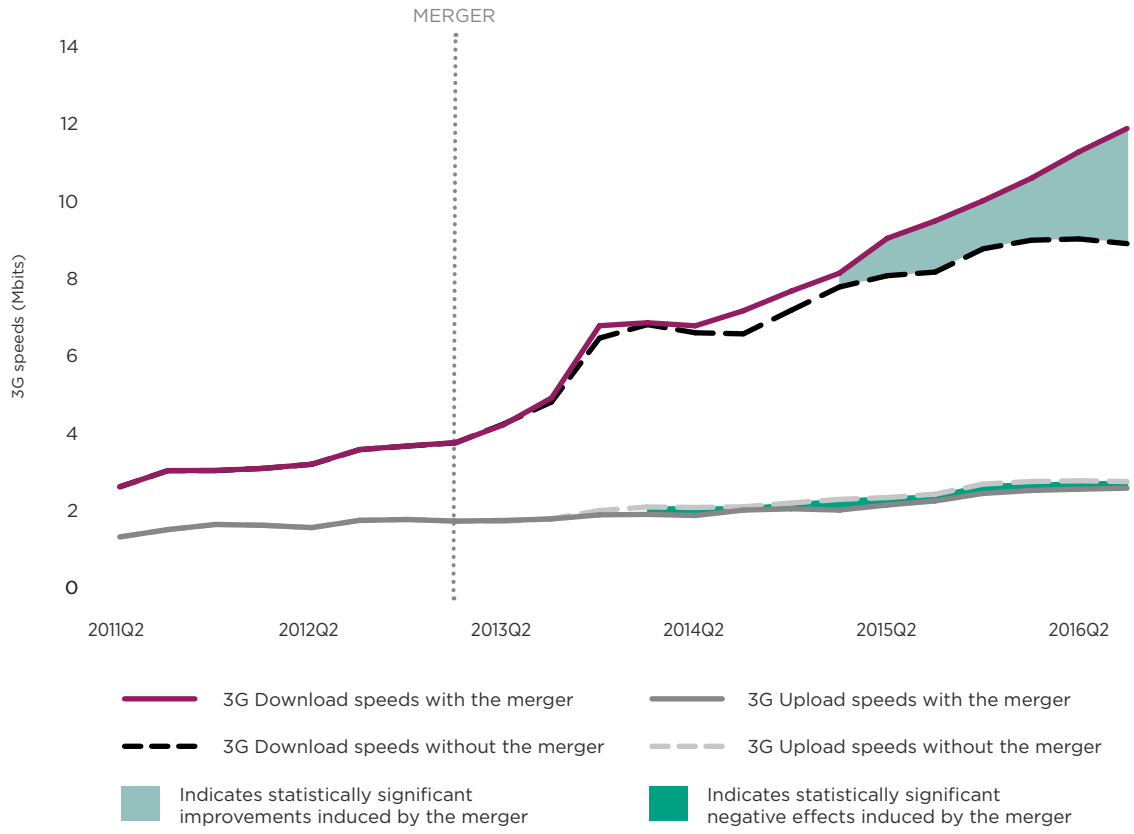
Market-wide merger effects

When we look at how the merger affected all Austrian operators, our estimates indicate that the merger induced an overall improvement in 3G network quality. As shown in Figure 10, download speeds were significantly higher than in the scenario without the merger from two years after the merger. We also identify a negative effect with regards to upload speeds, though its magnitude (both in relative and absolute terms) is more limited compared to the effect on download speeds.

Taking into account the fact that Hutchison's 3G networks were not, according to our results, affected by the merger, this analysis across all Austrian operators implies that A1 Telekom and T-Mobile improved the performance of their 3G networks. This finding is compatible with the results on 4G networks, where Hutchison's rivals increased their quality before the merged operator improved its networks. In the case of 3G, the improvement in network quality could be driven by an expectation that Hutchison would be able to improve its services – either due to additional investments and/or network efficiencies.

Figure 10

Effect of the merger on 3G performance across all Austrian operators



The trends without the merger are based on predictions of the Base DD model as specified in Model 2 of Table 6. Both trends with and without the merger reflect actual and simulated averages of network quality across Hutchison, A1 Telekom and T-Mobile.

Source: GSMA Intelligence

As shown in Table 6, our simulations indicate that 3G download speeds were significantly higher in the second year after the merger (0.5 Mbps) and during the period thereafter (1.5 Mbps) as compared to the scenario without the Hutchison/Orange merger. The complete analysis in Annex 3 shows that we can be particularly confident about the effect after two years.

We also found that the merger caused an average decrease of around 0.2 Mbps in 3G upload speeds across all Austrian operators, both in the second year and thereafter – with these impacts being robust to alternative specifications (see Annex 3). The decrease in upload speeds is lower in both absolute and relative terms than the increase in download speeds – the latter increased by almost 20% compared to the counterfactual without a merger, whereas upload speeds decreased by less than 10%.

Table 6

3G network quality base DD model – merger effects across all Austrian operators

	3G download speeds			3G upload speeds		
	(1)	(2)	(3)	(4)	(5)	(6)
Effect in 1st year	0.144	0.176	0.170	-0.046	-0.058	-0.047
Effect in 2nd year	0.527*	0.579*	0.559**	-0.189***	-0.209**	-0.189***
Effect after 2 years	1.434***	1.512***	1.465***	-0.228***	-0.258**	-0.229***
3G spectrum holdings	0.023	0.023	0.0234	0.006	0.006	0.006
Rural population		-0.165			0.063	
Population density (log)			0.0887***			-0.001
Observations	1320	1320	1320	1320	1320	1320
Adjusted R-squared	0.807	0.807	0.823	0.683	0.684	0.683

Significance level: *** 1%, ** 5%, * 10%.

Source: GSMA Intelligence

5. Conclusions

5.1 The effect of the Hutchison/Orange merger

This study analyses the impact of the Hutchison/Orange merger in Austria on network coverage and quality. It is the first of its kind to measure the impact of a mobile merger on network quality and innovation, two important parameters for competition that are increasingly valued by consumers in Europe. We find that overall the merger had a significant positive impact for Austrian consumers in terms of network innovation and quality. In particular, the results support important conclusions on three different aspects of merger assessment in the mobile sector:

- The study shows that Hutchison was able to accelerate the coverage of its 4G network by 20–30%, with this taking effect two years after the merger. Hutchison's 4G network quality also increased rapidly and significantly, with 4G download and upload speeds increasing by 7 Mbps and 3 Mbps respectively after two years. This result is explained by a number of dynamic efficiencies at play. The merger could have driven more investment in Hutchison's 4G infrastructure, because it increased the expected returns in the market and because it improved Hutchison's scale and financial position to invest, which would altogether strengthen investment incentives and ability. At the same time, Hutchison could have also realised efficiencies by aggregating assets and scale economies, as argued by the merging parties in the merger assessment.

- We find positive effects on the quality of mobile networks in the market as a whole, with 4G download and upload speeds increasing by more than 13 Mbps and 4 Mbps respectively in the first two years after the merger and 3G download speeds increasing by 1.5 Mbps thereafter. This suggests that the merger intensified competition across all operators in quality-related aspects. These results are consistent with recent evidence showing how mobile mergers can increase investment,[46] and provide an important complement to recent studies that have reviewed the impact of mobile mergers on prices.[47]

- The third conclusion concerns how Hutchison and Austria fared when compared with their peers in key European markets on innovation and quality. In Austria, a mobile market with three players after the merger, Hutchison delivered more widely available and faster 4G services than those experienced by consumers of similar operators in Europe. At the same time, Austrian consumers as a whole benefitted from faster 3G and 4G services compared to many other markets, including those with four players.

Overall, our findings show that a 4-to-3 mobile merger intensified competition in quality-related aspects and that a three-player market delivered more widely available and faster 4G services than those experienced in four-player markets. It also shows that a merger between the two smallest operators in Austria allowed them to significantly outperform other operators in Europe with a similar position in the market.
These results are important not only for Austria but also in the context of the broader debate about the impact of mobile mergers on consumer welfare.
While the scope of this study is confined to network coverage and quality changes in Austria, it provides robust evidence on the magnitude and nature of dynamic efficiencies and the consequent benefits for consumers that can arise from a mobile merger.

46. For example CERRE (2015); Houngbonon & Jeanjean (2016-a); Houngbonon & Jeanjean (2016-b); and HSBC (2015)
47. For example RTR (2016); BWB (2016); and DG Comp (2015)

5.2 Implications for competition policy and merger assessment

Our results show that mergers can induce significant dynamic efficiencies and realise direct benefits to consumers in mobile markets. This type of evidence should be considered in the early stages of merger reviews – in practice a substantive assessment of efficiencies only happens in later phases of merger reviews, and the burden of proof required often means efficiencies are in part or fully dismissed.[48] In particular, if we consider the three criteria used to consider efficiencies as set out in the EU Merger Regulation Guidelines, and the way that they were applied to this case[49], this analysis has important implications.

First, it shows that efficiencies and the impact they have on consumers can be measured. While this report presents a framework to model efficiencies as an ex-post evaluation, competition authorities should implement similar approaches when carrying their forward-looking analysis to anticipate merger effects. Currently such a forward-looking analysis is already carried out for prices, using tools such as the UPP test. The recent availability of data to measure quality and innovation should make it possible to develop a forward-looking analysis for estimating the impact of mergers on quality and innovation.

Second, it shows that efficiencies, and their impact on consumers, are in this case a direct result of the merger, and, hence, can be considered merger-specific. While it is in theory possible to combine two networks without a full merger occurring (i.e. through a network sharing agreement), it should not be considered as a default alternative to a mobile merger, since their ability to deliver efficiencies comparable with a merger depends on a series of factors, including the likelihood of such agreement taking place. In the Hutchison / Orange case, the EC concluded that the relevant comparison for evaluating the effects of the merger was the pre-merger status quo.

Third, the findings of this study show that efficiency effects can be significant, but they can take time to directly benefit consumers. For example, the 4G coverage results show that efficiencies started to materialize two years after the merger. For competition authorities to take into account all the relevant effects, it is important that merger control tools consider effects beyond the short-term.

Fourth, the study shows that a three-player market can outperform a four-player market in terms of innovation and quality of service.

Finally, the availability of measures of quality and innovation that support the findings of this study should also allow better assessments in anti-trust cases.

While this study addresses an important evidence gap in the debate about mobile consolidation, it also opens new lines of investigation that will benefit from further research in the future. Since the findings of this analysis are specific to Austria, additional research should focus on the impact of other mobile mergers (e.g. Germany and Ireland) or market structure more generally on quality and coverage. This will contribute to further building evidence on which competition authorities can base their decisions when considering dynamic efficiencies and the relationship between market structure and performance in mobile markets.

Future research should also look to assess the impact of mobile mergers on overall consumer welfare. There have already been studies looking at the impact on prices and investment. This paper has shown that it is possible to look at the impact on innovation and quality. The next wave of research should, therefore, bring all these outcomes together and consider the impact of mobile consolidation addressing all the key parameters that are important to consumers.

48. This is explained in the Competition Policy Handbook, especially in the chapter on efficiencies Key Concept 3, efficiencies in merger control (and footnote 223).
49. See Section 7 of the published final decision by the EC, http://ec.europa.eu/competition/mergers/cases/decisions/m6497_20121212_20600_3210969_EN.pdf

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